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OCTOBER 1991
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LETTERS

From the Hamshack

Bobby DeVito, Tampa FL I'm writing to let you know how much I enjoy your column in *73 Magazine*. I've been interested in amateur radio for almost 15 years now (I am 26), and just passed my codeless Tech exam last month. I am extremely thankful that I am now going to be a ham, and I will try harder to learn the code so I can be a General.

Even though I am a "no-coder," I still feel that I have as much or more to contribute to amateur radio as anyone. I've been involved in electronics since I was a child (my father helped develop the first GTE-Sylvania Technical Schools) and have been through the Navy BE&E and Electronic Warfare schools. I am a professional musician, working on my second album (sorry, but it's rock, not ragtime), and also do some studio engineering. And I've always loved ham radio! Now at least when I go on the road, I can take my HT with me and possibly make some friends, if they will condescend to speak with a "no-coder."

OK, now that I'm finished blowing my own horn, I can get to the heart of the matter. I really enjoy your column and I think that you are a positive force for the entire amateur community. You're a really good writer, and I enjoy your style. And your sense of humor.

You'll hear from me again. For now I'm stuck in VHF and UHF land, but I will make it to HF one day. If your ears can stand instrumental rock guitar music, I'll send you a copy of my last album, *Guitar Salad*. Hopefully, I'll be able to elmer some of my musician friends. Keep up the good work, and NEVER SAY DIE!

Sid Lynch KC4ZVJ, Jacksonville FL I would like to home-brew a 2 meter FM transceiver base station. Ideally, the rig will have repeater offset, digital frequency readout, and tone encode capability.

I'm having a great deal of difficulty locating construction articles or plans for such a rig. It seems that most construction articles focus on HF-QRP-CW rigs. Is there a reason for this, given the growth of the no-code Tech class that cannot legally operate such rigs?

Is it possible to home-brew a rig like the one I'm talking about without an electronics degree and a lab? I would appreciate any advice you may have that could lead me to information on such rigs.

I figure that if it is possible to get a decent VHF home-brew set on the air, this would open all sorts of other projects. For example, I would love to home-brew a packet station or perhaps get into satellite via home-brew.

Sid—You might want to check out Ramsey's 2m FM transceiver kit. They've been selling so well we haven't been able to get one for review yet.

As for a 2m FM total home-brew construction project . . . how about it, readers? If anybody's put together such a project, we'd love to take a look at it . . . . David N1GPH

Pete Stark K2OAW, Mt. Kisco NY I vote for "Poor Man's Packet" by WB2EMS and N8KEI as possibly the best ham radio article and project of the last 10 years, if not more.

I haven't built it yet, but I have a hunch the PMP project may have a feature the authors haven't mentioned: by eliminating the TNC with its CPU, etc., the PMP may also eliminate much of the QRM which normally makes it really tough to use an HT without a remote antenna.

Joel E. Dumont KA1LNJ, South Deerfield MA I have been a licensed amateur radio operator since 1984. This past spring, I upgraded to Technician, thanks to the encouragement of the Mount Tom Amateur Repeater Association's class, taught by K1MEA. I am now halfway to General class, having passed the written portion of the test.

I do not object to the possibility of paying a fee for an amateur radio license. In fact, I agree with the idea of paying $5 a year for the 10-year license. I sent cards to that effect to the representatives and senators listed in your July editorial.

I applaud your efforts to focus ham radio on fun, talking, and tinkering. After all, this is supposed to be a hobby, right? I think it is still possible for innovation to come from hobbyists, since most big companies tend to stifle creativity in the name of conformity and order. It may take a lot of money to develop and market things, but ideas come to those who have the time and interest.

W.E. Bennett N7IVM, Bellevue WA This time you've really done it. There are probably hams all over the U.S.A. who are foaming at the mouth! License fees!

Seriously, I have always felt that the decision to eliminate fees was a potential weapon to be used against amateur radio. My only reservation is whether it is possible to get the fees where they should be, into that section of the FCC which is concerned with our affairs. I don't want a free ride, but I would like my "fare" to help keep my "bus" on the road!

George C. Fennell N3EQE, Butler PA On the ham front in Butler County, things are really cookin'! I am pleased to announce that my latest Novice/Technician class yielded nine new ham operators to our ranks, six of them being "codeless Techs," and more are coming aboard due to the long overdue codeless license.

Also, ATV is alive, well, and being heavily promoted in the area. We are in possession of an ATV repeater and all the "goodies" to go with it, and have received permission from the local VA Hospital to place it in operation upon their rooftop tower. This location is prime, and will enable everyone in Butler and the county-wide area easy access to the machine. Right now there are seven individuals in the process of purchasing ATV gear, and many more contemplating the move.

Keep it up . . . you're our inspiration and guiding light!

Mark A. Stevens AB4YE This past lunch hour, I spent time reading over the last three years of gloom and doom from your editorials. Gasp! . . . I agree with you. We have no hope of keeping our frequencies with arguments to the FCC that we are a vital national resource, that the bands we have now are crowded, that we are on the cutting edge of technology, etc.

If we are going to be able to keep our frequencies . . . I think that we need to get down to basics. Business is going to do everything it can to lobby us out of our airspace. Problem is, there really is no room left for continuous growth of radio technology as it's now envisioned. As soon as they take our frequencies away from us, they will find that they still don't have all the room they need, and they will have to develop other ways of transmitting data for profit. (As archaic as they look now, phone lines hold more promise for data transmission than do radio waves.) One of our first priorities must be to convince the FCC of this fact: Ham radio's frequency space is only a small crack in the wall of physics that limits the amount of usable radio frequency space available for profit making. Once our ham bands are gone, they're gone for good . . . and for nothing.

We need to look at our ham bands as a valuable, disappearing national resource, just as we look at our national forests. As hams, we have to stop telling ourselves how valuable we are, how important our mission is, and start telling the government how valuable public frequency space is to the nation. We need to make it known to anyone who will listen that we love our radios the way some people love their campers or motorcycles or coins or guns. We need to make our case for our right to keep what we enjoy.

We need to cease being a bunch of emergency chasing, council meeting, jurisdiction disputing political idiots who do nothing but set up ego gratifying repeater councils and radio societies, then spend any remaining time trying to find someone to take to court. We need to become a unified group of hobby-loving individuals who will effectively let the world know how much we appreciate the little reserves of public frequency space we now have . . . .

We are not on a mission from God. We need our national parks, and we need our international frequencies . . . not because we are an asset to the nation, but because the frequencies are an asset to the public, an asset too valuable to leave entirely to business interests.

I, as a ham, am not an indispensable asset vital to the correct functioning of our military and emergency services . . . ham radio is an asset to me personally. I know that the world could get along without me, but I surely don't know what I (we hams) would do without ham radio.

Jeff Kinsman NH6VH From time to time we all get a bit disillusioned with amateur radio. Then something comes along to refresh our sense of wonder and faith in hams and the hobby. Something like that happened to me last spring when we were in the Persian Gulf with "Desert Storm," I'm the chief operator of the MARS station onboard the aircraft carrier *USS Nimitz*. In addition to running phone patches via MARS, we've formed a group of amateurs to promote ham radio onboard. Anyway, as luck would have it, we "smoked checked" the finals in our amplifier when we got underway. Sure enough, when we arrived in the Gulf, we couldn't contact any MARS stations back in the states using a barefoot rig. With over 6,000 men on *Nimitz*, the need for contact with home is vital. We thought we were sunk—literally! To my surprise, amateurs all over the U.S. responded to our call for help. They stayed up late running patches (many times at their own expense), relayed message traffic, and generally kept our spirits high during a difficult deployment.

Their extra effort proved to me that although we have our differences in the hobby, when the chips are down, we pull together and bring out the best we have to offer. Isn't *that* the foundation of amateur radio—service to fellow citizens? The next time you're depressed after reading gloom and doom letters, ask a sailor from the *USS Nimitz* what he thinks of ham radio—your wonder and faith will be renewed!

Daniel M. Jordan AA9AN, Evansville IN I am writing this letter about contests on the amateur bands. I have been an amateur radio operator for 15 years now. I am 28 years old, and have a family. Since my job and my family take up a lot of time, I usually try to get on the radio on the weekends when I can. But it seems to me every weekend there's another contest.

Now, don't get me wrong; I have nothing against contests. I'm sure they're an exciting aspect of the hobby. But why should a few people's enjoyment ruin it for everybody else? I'm not saying do away with contests, but limit them to a certain portion of each amateur band. Just look at the contest section of each amateur publication and it's packed. Every little club has its own contest weekend. Before long, there won't be standard ham radio contacts, just one long 365-days-a-year contest. I ask that any ham who is tired of being interfered with to please drop the FCC a note and voice your opinion. Maybe together we can all use our radios again.

Daniel—Please don't bug the FCC. This is not a situation where they could or would do anything—except get even more disgusted with ham operators who come crying to them every time they don't like something. Why don't you try writing a clear and constructive letter to the organizations who sponsor the contests? They are the ones who can change the contest rules. Your idea has merit. Just make sure you direct your energy in a positive way—and toward the proper authority . . . . David N1GPH

Darrell Davis KC4KGN, Fort Meade FL I enjoy reading your editorials every month. I have been licensed for a little over two years now and have enjoyed every bit of it. I got into amateur radio because of computers and computer communications, and experimenting, which I enjoy. I do mostly digital on HF and very little phone except checking into the ARES Net on HF. I am an assistant E.C. for ARES here in Polk County. Only phone I do is on 2 meter FM repeater or simplex. Trying to get started in satellite. I am 22 years old, so you do not have to be an old-timer to enjoy this hobby.

I am afraid that your predictions will come true unless some changes are made. The old men on our bands need to get out of their "live and die by CW" attitude and realize that Part 3 of the Amateurs Code exists: "The Amateur is Progressive." I like your end-chewing of your readers to get them to think for themselves.

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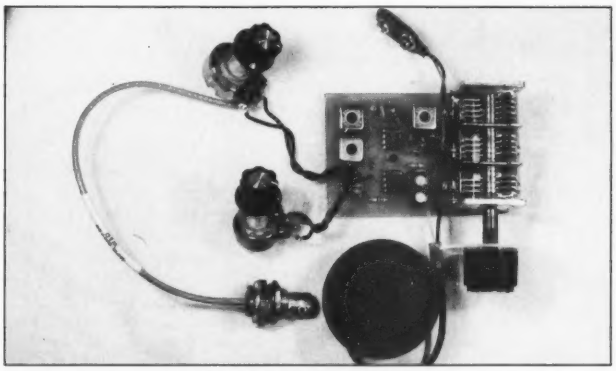

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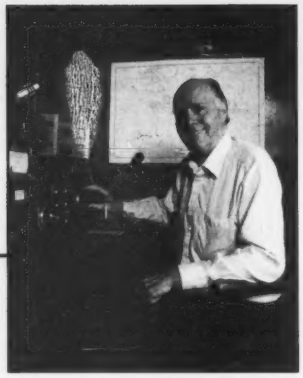

NEVER SAY DIE

Wayne Green W2NSD/1

Wayne's Ego

Now and then I get a nastygram bitching about my inflated ego. I'm not sure why readers are concerned about me not having a low sense of self-esteem. Sure, I enjoy getting appreciative letters and I hate getting nasty ones. I particularly love getting letters from readers who tell me I've had a positive effect on their lives.

Yes, I do tend to aim my writing toward my more intelligent readers, but not out of arrogance or imperiousness . . . I just don't feel comfortable talking (writing) down to people. It isn't in my mind to say, hey, look how incredibly smart I am . . . look how much I know. I write to help people understand things. No one can be an expert on everything, including me. But I do feel a need to share the things that I've learned or enjoy with others.

I keep urging you to try new ham activities. But I haven't asked you to do anything I haven't done. I've done moonbounce, made many OSCAR contacts, worked seven states on 10 GHz, won Sweepstakes, VHF and DX contests, DXpeditioned from dozens of countries, worked around 350 countries, and so on. I helped pioneer NBFM, SSB, RTTY, SSTV, etc. I've built all kinds of gear . . . and I've had so much fun doing all this that I've probably been a nag trying to get you to share my fun.

Yes, of course I have an ego. You mean you haven't? And I like you to know some of my wins. But I also share my bad times with you . . . like my loss of *Byte*, one of the worst traumas of my life. And my bout with the IRS, which probably ties with the *Byte* epic.

Like most of you, I do dumb things. Like letting myself be talked into running for VP a few years ago. It seemed like a good way to get some exposure for my ideas on improving education, solving the welfare mess, and helping the homeless. I let my enthusiasm carry me away into lala land. I should have known that the media has virtually zero interest in constructive, creative ideas. They're after bad news, so they concentrated on my old IRS debacle. Bad news sells papers, and journalists aren't about to forget it.

I was reminded of that when an ex-governor of New Hampshire called recently and asked if I would consider running for VP again. I gather there is a lot of anxiety about Quayle and many politicians are looking for viable alternatives. Not me, thanks. I'm an idea person, not a politician.

As I said at the time I ran, my concept of the vice-president was that he should be responsible for running national affairs, while the president would handle the international stuff. That's almost what we actually got. Bush *has* been handling foreign affairs. It's just that, as far as I can see, no one's been running the country.

A corporate VP has responsibilities other than twiddling his thumbs, waiting for *the* call. A VP is usually responsible for running a major aspect of the business. Well, why should running the country be different?

I think we all agree that the country would do better with some management. Our educational system is a disaster. The drug problem hasn't improved, despite task forces and endless propaganda. Crime is still getting worse. I'm not aware of any changes in the welfare mess, in improving the unemployment situation, or helping ease the homeless problem. Look at the S&L, the BCCI and other banking messes, our decaying infrastructure, the HUD disaster, the continuing defense contracting and environmental messes! Quayle, what in hell have you been doing? Playing golf and making "good will" trips?

Medical costs are going up faster than inflation. College costs are zooming. Organized crime is stronger than ever. Heck, I'm up against 'em in *two* of the industries I'm in. With no national leadership, there's no reason to expect things to improve.

Yes, I probably could help with many of those problems, but I don't need the aggravation. No amount of money could get me involved with the bureaucractic quagmires involved. Not even my vaunted ego could do it. I'm very busy and happy doing what I'm doing.

Both Bush and Reagan have handled the situation well. They've kept their hands off running the country and blamed Congress for everything. Maybe you missed the 7/22 *Time* editorial (p.70) on exactly that subject. Too bad; you shouldn't.

To help amateur radio grow faster, I've started *Radio Fun*. I believe this will help lots of hams get more fun from our hobby. I hope it will make learning theory more fun. I hope it will make trying new modes and bands more fun too.

But I'm also in the middle of starting a new company to put out sampler CDs to help the record companies get their new releases selling faster. Major New Releases (MNR) is gearing up to put out two or more samplers a month. We'll be sending these CDs to some 10,000 record stores, bundled with our *Music Retailing* publication . . . and giving another 15,000 or so absolutely, totally, completely, 100% FREE to my *CD Review* readers.

My Adventures In Music (AIM) samplers (also FREE) project, each with tracks from 16 or so different independent record company releases, has been a huge success . . . and needs to be expanded.

Another new project is our *IMPS Journal*, which will go monthly to over 5,000 independent music producers. Then there's our *Guide to FREE Music*, starting in November. And more CD releases from my Greener Pastures Records. Yep, I'm busy. My only major problem is a desperate need for more people to help do all these things.

I'd love to organize ham tours to Europe, Africa and Asia. The hams there would love to meet us and host us. But travel costs money, and most hams seem to be terribly short of that. Where have all of you been while the banks were handing out billions? Were you holed up in your hamshack dit-dahing while the money trees were being stripped?

I remember one creative ham who went around the world, visiting rare countries and charging top dollar to DXers for contacts. He told me he was pulling down around a quarter of a million a year. I don't think he was exaggerating.

I organized a ham European tour back in 1963. It was a corker, with 73 of us on the trip. We had hamfests in London, Paris, Geneva, Rome, and Berlin. None of the hams on that trip will ever forget it! I see several of them every year at Dayton and they still remind me how much fun they had.

I tried to do another in 1965, but by then ARRL's "incentive licensing" proposal had gutted the hobby, and it was all over. I did conduct electronic and computer tours to Asia in the '80s, but we seldom had more than a dozen hams along . . . compared to 250 on the tours.

Now I'm planning some music industry tours, which should be fun. But wouldn't you enjoy going to Africa with me and getting on the air from 3D6 or 7P8? Wouldn't you like to visit ZS and talk with the local hams and get their perspective on what's going on down there? They'd love to have you come, I promise you.

Alas, before I can round up ham tour groups and lead them fearlessly to exciting new adventures, hams are going to have to have more disposable income. Any red-blooded ham would love to get on the air from a rare country and brave the pileups. Talk about ego! Suddenly you're a star and the whole world is groveling at your feet for the kiss of your QSL. Oh, if you only had the money, what a fantastic time you could have!

But making money means changing. Most people have never made any more money than they needed. Heck, they've never made quite as much as they feel they need. But making money means working harder, and we're all basically lazy, so we make do and begrudge those who do work harder the fun they can afford.

A few people either luck into it or are smart enough to figure out how to make more money without having to work so hard. It doesn't take a computer scientist to notice that entrepreneurs seem to have a much better batting average on getting rich than people working for the government, for large corporations or teaching. Hmmm, with the same amount of effort, you stand a chance of hitting the jackpot. Golly!

So I've been irritating the hell out of *73* readers for the last 30 years pointing this out. My ego does expand momentarily when I hear from a reader who's taken my advice and found it worked. But most hams . . . and for some reason this seems to be particularly centered on ARRL stalwarts . . . put me down as crazy and keep on staying poor. I've never met either a smart or a rich ARRL supporter . . . and I've sure met a lot of hams.

I used to spread my gospel via my computer magazines, too . . . and now I'm at it in my music magazines. Is all this ego driven? It doesn't seem like it to me, but then how many of us recognize our faults? I love it when I hear from someone I've helped . . . and I brag a little at the time. But I don't forget that gratitude is one of the least felt of human emotions, so I expect I'll have as many friends at my funeral as I did to support me when the IRS did a job on me. And, at 69, that funeral is getting closer. Makes it more difficult to make long-range plans . . . which hurts, because there's so much that needs to be done and so few people interested in helping.

Amateur radio is the greatest and most valuable hobby in the world. It should be spread to every third world country so they'll be able to cope with

Continued on page 80

KENWOOD

Compact Champion!

TH-27A/47A

2 m and 70 cm Super Compact HTs

Here is a great new addition to Kenwood's HT family – the all new TH-27A for 2 meters and TH-47A for 70 cm! Super compact and beautifully designed, these pocket-sized twins give you full-size performance.

- **Large capacity NiCd battery pack supplied.** The standard battery pack is 7.2 volts, 700 mAh, providing extended transmit time with 2.5 watts. (TH-47A: 1.5 W.)
- **Extended receive coverage.** TH-27A: 118–165 MHz; TH-47A: 438-449,995 MHz. TX on Amateur bands only, (TH-27A modifiable for MARS/CAP. Permits required. Specifications guaranteed for Amateur bands only.)
- **Multi-function scanning.** Band and memory channels can be scanned, with time operated or carrier operated scan stop.
- **Frequency step selectable for quick QSY.** Choose from 5, 10, 12.5, 15, 20, or 25 kHz steps.
- **Built-in digital clock** with programmable timer.
- **Dual Tone Squelch System (DTSS).** Compatible with the TH-26AT Series and the TM-941A Triple bander, as well as other Kenwood series transceivers, this selective calling system uses standard DTMF to open squelch.
- **Five watts output** when operated with PB-14 battery pack or 13.8 volts.
- **T-Alert for quiet monitoring.** Tone Alert beeps when squelch is opened.
- **Auto battery saver, auto power off function, and economy power mode extends battery life.**
- **DTMF memory.** The DTMF memory function can be used as an auto-dialer. All characters from the 16-key pad can be stored, allowing repeater control codes to be stored!

- **41 memories.** All channels store receive and transmit separately for "odd split."
- **DC direct in operation.** Allows external DC to be used (7.2 – 16 volts). When external power is used, the batteries are being charged. (PB-13 only.)

Optional accessories:
- **BC-14:** Wall charger for PB-13
- **BC-15:** Rapid charger for PB-13, 14
- **BC-16:** Wall charger for PB-14
- **BH-6:** Swivel mount
- **BT-8:** Six cell AA Alkaline battery case
- **HMC-2:** Headset with VOX and PTT
- **PB-13:** 7.2 V, 700 mAh NiCd pack
- **PB-14:** 12 V, 300 mAh NiCd pack
- **PG-3F:** DC cable with filter and cigarette lighter plug
- **PG-2W:** DC cable
- **SC-31:** Soft case
- **SMC-31:** Standard speaker mic
- **SMC-32:** Compact speaker mic
- **SMC-33:** Compact speaker mic with controls
- **WR-2:** Water resistant bag.

- **Automatic offset selection (TH-27A).**
- **Direct keyboard frequency entry.** The rotary dial can also be used to select memory, frequency, frequency step, CTCSS, and scan direction.
- **CTCSS encode/decode built-in.**
- **Supplied accessories:** Rubber flex antenna, battery pack, wall charger, belt hook, wrist strap, dust caps.

Specifications and features are subject to change without notice or obligation.
Complete service manuals are available for all Kenwood transceivers and most accessories.

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TS-950SD

"DX-clusive" HF Transceiver

The new TS-950SD is the first Amateur Radio transceiver to utilize Digital Signal Processing (DSP), a high voltage final amplifier, dual fluorescent tube digital display and digital meter with a peak-hold function.

- **Dual Frequency Receive Function.** The TS-950SD can receive two frequencies simultaneously.
- **New! Digital AF filter.** Synchronized with SSB IF slope tuning, the digital AF filter provides sharp characteristics for optimum filter response.
- **New high voltage final amplifier.** 50 V power transistors in the 150-watt final section, resulting in minimum distortion and higher efficiency. Full-power key-down time exceeds one hour.
- **New! Built-in microprocessor controlled automatic antenna tuner.**
- **Outstanding general coverage receiver performance and sensitivity.** Kenwood's Dyna-Mix™ high sensitivity direct mixing system provides incredible performance from 100 kHz to 30 MHz. The Intermodulation dynamic range is 105 dB.
- **Famous Kenwood interference reduction circuits.** SSB Slope Tuning, CW VBT (Variable Bandwidth Tuning), CW AF tune, IF notch filter, dual-mode noise blanker with level control, 4-step RF attenuator (10, 20, or 30 dB), switchable AGC circuit, and all-mode squelch.

Complete service manuals are available for all Kenwood transceivers and most accessories.
Specifications, features and prices subject to change without notice or obligation.

The Ultimate Signal.

DSP is a state-of-the-art technique that maximizes your transmitted RF energy

- **High performance IF filters built-in.**† Select various filter combinations from the front panel. For CW, 250 and 500 Hz, 2.4 kHz for SSB, and 6 kHz for AM. Filter selections can be stored in memory!
- ***Multi-Drive Band Pass Filter*** **(BPF) circuitry.** Fifteen band pass filters are available in the front end to enhance performance.

- **Built-in TCXO for the highest stability.**†
- **Built-in electronic keyer circuit.**
- **100 memory channels.** Store independent transmit and receive frequencies, mode, filter data, auto-tuner data and CTCSS frequency.
- **Digital bar meter.**

Additional Features: • Built-in interface for computer control • Programmable tone encoder • Built-in heavy duty AC power supply and speaker •Adjustable VFO tuning torque • Multiple scanning functions • MC-43S hand microphone supplied

Optional Accessories

- DSP-10 Digital Signal Processor *
- SO-2 TCXO* • VS-2 Voice synthesizer
- YK-88C-1 500 Hz CW filter for 8.83 MHz IF*
- YG-455C-1 500 Hz CW filter for 455 kHz IF*
- YK-88CN-1 270 Hz CW filter for 8.83 MHz IF
- YG-455CN-1 250 Hz CW filter for 455 kHz IF*
- YK-88SN-1 1.8 kHz SSB filter for 8.83 MHz IF
- YG-455S-1 2.4 kHz SSB filter for 455 kHz IF*
- SP-950 External speaker w/AF filter
- SM-230 Station monitor w/pan display
- SW-2100 SWR/power meter
- TL-922A Linear amplifier (not for QSK)

* Built-in for the TS-950SD
† Optional for the TS-950S

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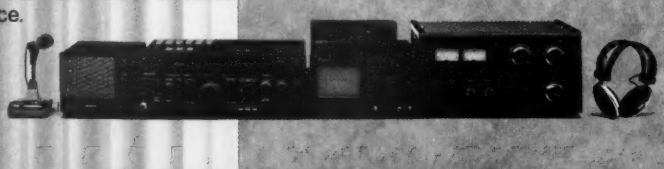

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

Calling All Hams

In March 1992, a space shuttle launch is planned with the first mission in a series of 10 flights called ATLAS-1 (Atmospheric Laboratory for Applications and Science). One of the payloads, SEPAC (Space Experiments with Particle Accelerators), will investigate the ionosphere and magnetosphere. SEPAC will use an 8 kW electron beam modulated as a VLF transmitter by audio tones between 50 Hz and 7 kHz. Attempts will be made to receive and record this signal on earth at various locations.

Since there are a limited number of ground stations, high school classes and the amateur experimental community are encouraged to participate in listening to and recording transmissions. The footprint of the VLF signals will be difficult to define without a large number of ground receiving stations. A low cost ($35 to $40) kit receiver has already been designed and tested by amateurs. The complete kit, with full documentation and project details, is available this fall.

The student effort has been dubbed INSPIRE (INteractive Space Physics). This will be the first time in history that such an extensive data taking capability has been available to space physics researchers. Some 10,000 high schools will be invited to participate. Participants will also benefit from the experience of assembling a simple but effective broadband VLF receiver, getting hand-on experience in obtaining scientific data, and coordinating a field station.

During the actual mission, amateur radio will play a vital role in relaying schedule changes for SEPAC transmissions. Amateur radio is already being used for daily premission communications regarding high school involvement. Most importantly, local ham clubs and individual amateurs can help students with kit building and setting up field listening operations. Individual amateurs are also invited to participate as ground stations during the mission.

For more information on the high school connection with project INSPIRE, send an SASE (two stamps) to Bill Pine, Science Department, Chaffey High School, 1245 N. Euclid Avenue, Ontario CA 91762. Interested hams and clubs should contact (also include a two-stamp SASE) Jim Ericson KG6EK, 226 Charles St., Sunnyvale CA 94086-6063. *TNX Jim Ericson KG6EK.*

New UHF DX Record

Two new microwave world records were set on Sunday, July 29, when Paul Leib KH6HME, at the 8200-foot level of the Mona Loa volcano, made contact with Chip Angle N6CA in Southern California on 3456 MHz at 2325 UTC. The short CW contact brought a signal report of RST 319 over the 2,471-mile long path. An hour later, at about 2425 UTC, Leib and Angle made a similar CW contact on 5760 MHz, setting a new world record for that band. Each of the stations was running 5 watts output to a 4-foot dish antenna, using equipment specifically designed for the path by N6CA. Both contacts were monitored, recorded, and verified by other amateurs living in the Southern California area. *TNX Gordon West WB6NOA and Bill Pasternak WA6ITF for their report in the* WESTLINK Report.

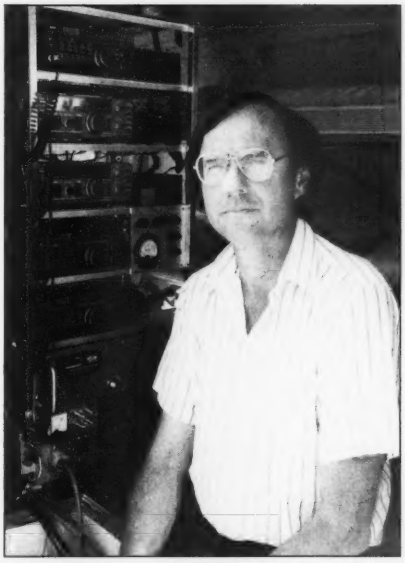

Photo A. Chip Angle N6CA in his record-breaking portable microwave station. Photo by Gordon West WB6NOA.

U.K. Novice License

Now that the first Novice licenses have been awarded in the U.K., the media is showing interest. On the BBC's "newsround," Natasha Weir 2E1AAE was seen contacting G3OUF/P, and Vicky Foster 2E1AAD was covered on BBC "Radio 5." Interviews are lined up for the TV program "Why Don't You . . ." and other TV and radio features are planned. These will be reported in full in a future issue of *Radio Communication.* Amateurs will now be hearing Novice licensees coming over the air, and all the help and patience given to these youngsters—and the not-so-young newly licensed—by experienced hams, will ensure mutual enjoyment of the hobby. Novice callsign prefixes are: England, 2E; Scotland, 2M; Wales, 2W; Isle of Man, 2D; Jersey, 2G; Guernsey, 2U, and Northern Ireland, 2I. In all cases, these prefixes are followed by either a Ø for Class A or a 1 for Class B licenses. TNX *WESTLINK Report, Number 607,* and GB2RS.

Reciprocity with Mexico

According to Rudy Baca of the FCC, the final reciprocal amateur operating arrangement with Mexico would be similiar to the agreement the U.S. has with Canada. "The goal is complete reciprocity with Mexico . . . the operating parameters are still being worked out. We expect to have a fairly detailed press release shortly. It is a matter of clearing everything with Mexico."

Over a year ago, near Mexico City, at a U.S./Mexico Consultative Group on Communications conference, Ralph Haller N4RH of the Private Radio Bureau suggested that reciprocity would be an appropriate topic. After a year of study and exchange of information, a second U.S./Mexico conference was held last July in Chestertown, Maryland. The FCC will issue a public notice describing all procedures in the reciprocal agreement when they are final. TNX *W5YI Report, Vol. 13, Issue #16.*

Soviet Goodwill Trip

David Larsen KK4WW, John Douglas NØISL, and Bob Fribertshauser W6YMR, members of the Foundation for Amateur International Radio Service (FAIRS), visited the *Radio Sport Federation* staff in Moscow last spring. The FAIRS members, also known as the "59 Group" were on a three-week goodwill mission delivering equipment to Soviet amateurs for emergency digital radio communication. Nine computers, nine TNCs, two HF transceivers, four HTs, and three VHF transceivers were donated by various companies. FAIRS Soviet amateurs involved in the project were Victor Goncharsky UB5WE, Yuri Katuytin UA4LM, Helen Goncharsky RB5WA, Victor Golutvin UB5WPR, and Vladimir Kiebanovsky UB5WCV. TNX *FAIRS.*

AREMIR

This month—October 2–12—an Austrian cosmonaut will operate AREMIR (Austrian Amateur Radio Experiment) aboard Mir. It will be part of a 16-experiment package called AUSTROMIR '91. AREMIR equipment will include a modified Alinco DJ-120E transceiver for 2 meters (power limited to 3 watts), a TNC and CW generator for the AREMIR beacon, and a laptop computer for packet. The exact frequency hadn't been determined at the time of this news release, but look for it around 145.8–146.0 MHz. Continuous packet bulletins are to be 36 characters long, with a six-second tone for Doppler measurements.

AREMIR has a strong educational focus, and an Austrian team of hams has created a special receiver for Russian and Austrian schools. TNX *SpaceNews, MCImail, John Magliacane.*

The Sudden Receiver

A simple-to-build receiver for 160–20M.

by Rev. George Dobbs G3RJV

It is sometimes said that the age of the amateur radio builder has gone. In the "great days," there was a huge electronic scrap yard left over from World War II, and hams could buy cheap parts and equipment just waiting to be modified for amateur radio use. They were good days; I remember well a local radio surplus store in my small home town in the north of England which had items that even a schoolboy could afford to buy. The store has now long since gone, and so have those bargain surplus items.

But my belief is that times have never been better for the ham who wants to build his own equipment. The world is full of electronics; from life-saving equipment to novelty junk, it is around us all the time. Smaller components, safer voltages and cleaner techniques mean that equipment can be built on a tray on the kitchen table—and cleared away after use. Components have never been cheaper; compare the price of electronic parts 30 years ago and now, and then compare average incomes. It is cheaper, easier and more convenient to build electronic equipment than ever before. I suspect that motivation, rather than means, is why more of it is not done.

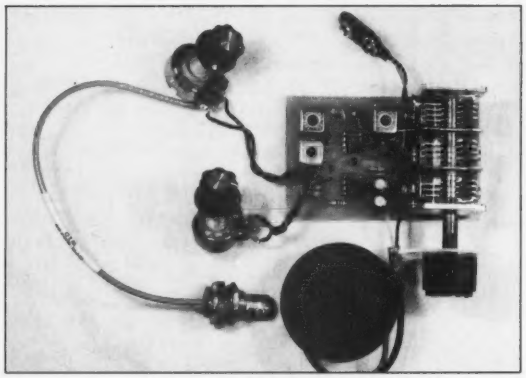

Photo. The Sudden receiver.

There may not be the surplus items we used to find, but there is another kind of surplus these days. It is what I call the "scraps from the rich man's table." Modern technology has produced many specialized components and items for a particular job. If they are for consumer applications, the high sales volume often means that cheap, and sometimes clever, devices can be found. These may not be for applications directly related to amateur radio, but that is the joy of the new surplus market. The fun is taking cheaply produced devices designed for special applications, and making them fit what we want to build. That is real amateur radio in action!

In the UK there have been indications in recent years of a revival in home construction among radio hams. This has been shown by the popularity of the G-QRP Club and its little journal, SPRAT. The club has always leaned heavily towards the use of home-built equipment, and SPRAT has grown into an informal constructor's magazine. Perhaps part of its popularity is due to the number of simple construction projects that have been published in SPRAT. Many amateur radio constructors in the UK have found their first radio project in its pages. I proffer all this cheerful information because I edit SPRAT, and for many years I have tried to include projects suitable for the beginner.

In the past, SPRAT has contained many simple HF bands transmitter circuits which can be built in an evening with a few parts. These give the experience of working on an amateur band with a few watts of home-generated RF. *[Ed. Note: Those in the U.S. can join the G-QRP club and receive SPRAT for $12/year from Luke Dodds W5HKA at 2852 Oak Forest, Grapevine TX 76051. Overseas readers can obtain more information directly from the author.]*

Recently there have been requests to provide a very simple receiver circuit for the amateur bands capable of being built by a first-timer and yet able to yield reasonable results on the amateur bands. The Sudden Receiver was the result of this request.

The Sudden Conception

The name "Sudden" has nothing to do with the speed and ease of building this little radio (even though it is simple and easy to build); rather, it is the name of the town where it was conceived. I live in Rochdale, a

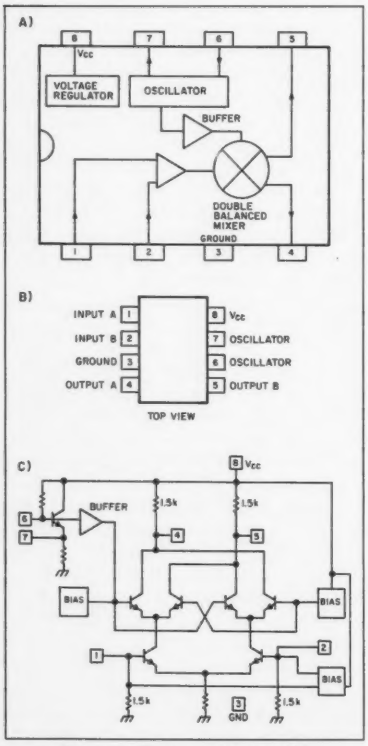

Figure 1. The Signetics NE602.

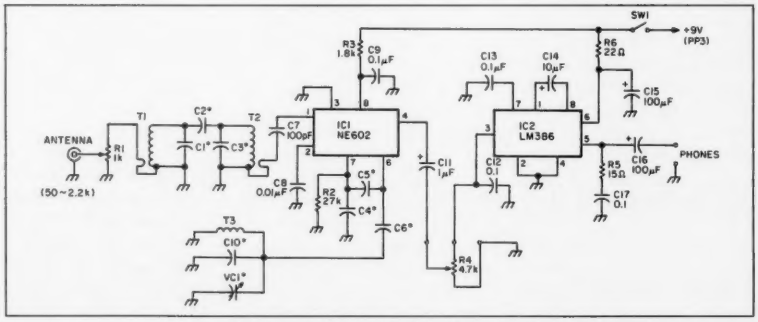

Figure 2. Schematic of the Sudden Receiver circuit.

...The Perfect Solution

If you're living in an area with antenna restrictions, if you're tired of hassling with huge multi element yagis or if you're just looking for a compact, rugged, easy-to-use portable antenna that really *works*, the 150 watt IsoLoop 10-30 (MHz) HF Antenna is the Perfect Solution to your antenna problems.

The IsoLoop 10-30 has been redesigned to provide greater durability, lower SWR and extended frequency coverage. Because the loop is isolated from the feedline, your radiated power goes into the antenna, not into the shack. Efficiency is maximized because the new design has no mechanical joints and no assembly is required. **No ground plane or antenna tuner needed!**

The IsoLoop comes fully assembled complete with LC-2 Loop Controller (including signal strength LEDs) and 50 feet of control cable in a UPS shippable package.

This HF antenna goes where few others have gone before!

See the IsoLoop 10-30 today at your favorite AEA dealer.

For a complete specification sheet on this or any other AEA product, call the toll-free AEA Lit-Line at 1-800-432-8873.

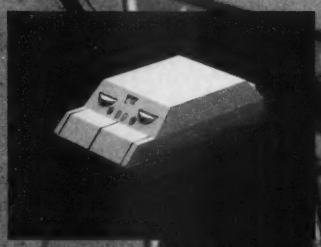

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Table. Component Values for Different Bands

Band	C1	C2	C3	T1	T2	VC1 + C10	C4	C5	C6	T3	
160	220 pF	10 pF	220 pF	BKXN-K3333R	BKXN-K3333R	All Sections +	100 pF	0.001 µF	0.001 µF	560 pF	BKXN-K3333R
80	47 pF	3 pF	47 pF	BKXN-K3333R	BKXN-K3333R	All Sections +	100 pF	0.001 µF	0.001 µF	560 pF	BKXN-K3334R
40	100 pF	8.2 pF	100 pF	BKXN-K3334R	BKXN-K3334R	1 Section +	47 pF	560 pF	560 pF	270 pF	BKXN-K4173AO
30	47 pF	3 pF	47 pF	BKXN-K3334R	BKXN-K3334R	1 Section +	68 pF	680 pF	680 pF	220 pF	BKXN-K3335R
20	100 pF	3 pF	100 pF	BKXN-K3335R	BKXN-K3335R	1 Section +	68 pF	220 pF	220 pF	68 pF	BKXN-K3335R

town in the northwest of England, in an area called Sudden. Sudden was once a village in its own right, and has a fine, stone-built Church of England church where I serve. I am the Vicar of Sudden, who just happened to design a simple radio receiver.

The Sudden could be described as a generic NE602 direct conversion receiver. It uses that fine and useful chip, plus the ever-popular LM386 audio chip. Another requirement of the design was to avoid the use of hand-wound coils, a common source of problems for beginners, and incorporate commercial inductors. The final design used a range of TOKO coils, given the UK designation KANK - - - - - . *[Ed. Note: In the U.S. the TOKO prefix is BKXN-K.]* These have a range of inductance values useful for short-wave applications.

The NE602 is a fine example of the kind of "rich-man's scraps" we have today. It was originally designed for cellular radio applications, but has found its way into many amateur radio circuits. The internal workings and pinouts are shown in Figure 1. It is indeed a useful device: a balanced mixer, RF oscillator, and voltage regulator all wrapped up in one small, 8-pin DIP package. All the main workings of a direct conversion receiver under one roof!

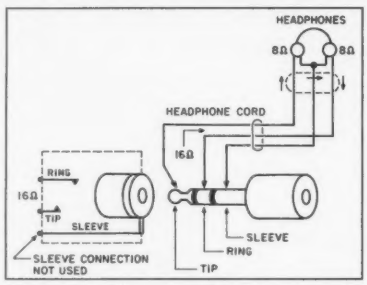


Figure 3. Walkman-type headphones can be used without changing the plug.

Circuit Details

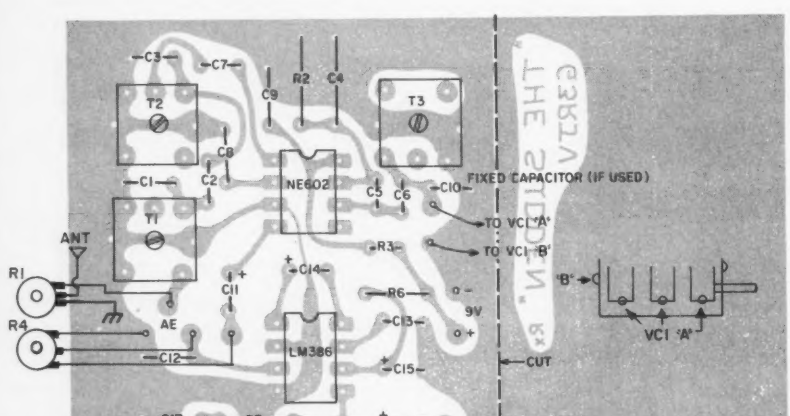
The circuit of the Sudden is shown in Figure 2. It is a simple receiver having only two active devices and three inductors. The input comes via a simple attenuator, the judicious use of which is essential, especially on the 40 meter version in the UK. T1/T2/C1,2,3 form a bandpass filter. The band chart table gives values for the appropriate TOKO coils. The values are calculated to give a flat response across each band. Once the filters have been peaked with the coil cores, there is no further need of adjustment during operation.

C7 couples the signal into one port of the NE602. The mixer is operated single-ended, which is a compromise in favor of simplicity. A similar design, the Neophite (*QST*, February 1988), used a balanced configuration. In practice I have found that the results with this circuit did not warrant the extra complexity in obtaining a balanced input and output.

The oscillator portion of the NE602 is around pins 6 and 7. Looking at the circuit, if it is turned sideways, experienced constructors will recognize the popular parallel tuned Colpitts oscillator. Tuning is by means of T3 with VC1 and C10. The prototype receivers used a surplus variable capacitor which has three gangs of approximate values: 10 pF + 10 pF + 20 pF. It may be possible to find a similar capacitor (see the Parts List), or you can use a single section variable capacitor. It is essential to use a good quality air-spaced capacitor. The values on the band chart show the values for C10 when using the prototype variable capacitor. With other capacitors, some experimentation will be required. The kit version of the Sudden uses the values and the capacitor from the table.

The single-ended output is coupled via C11 to a volume control, then into the LM386 audio amplifier. The LM386 is configured in as a 200 times gain amplifier with a simple Zoebel filter R5/C17 on the output. The audio output will drive a small speaker, but is designed for headphone reception. A pair of Walkman-type headphones are adequate for the receiver (see Figure 3). It saves family arguments if you are using in-house teenager headphones on the receiver.

Figures 4(a) and (b) show the layout of the receiver. The receiver fits onto a printed circuit board measuring 2" x 2". The board shown here has been extended to mount the three-gang variable capacitor used in the prototype receivers. This portion can be cut away to give a smaller size with the variable capacitor mounted remotely from the board.



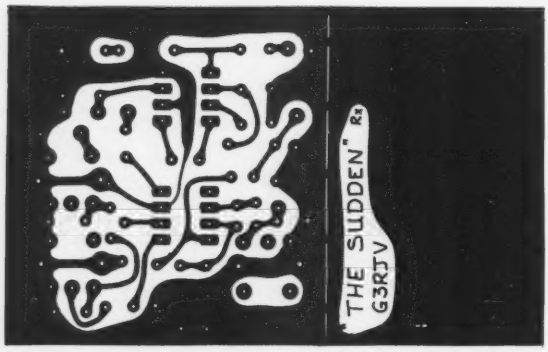


Figure 4. (a) Parts layout for the Sudden Receiver and (b) the foil diagram.

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MFJ-949D Deluxe 300 Watt Tuner

Covers 1.8-30 MHz . . . plus you get dummy load, peak reading meter, antenna switch, balun and one full year unconditional guarantee . . . for only $149.95

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A lighted peak reading cross-needle meter that shows you SWR, forward and reflected power. A 6-position antenna switch lets you select 2 coax lines (direct or thru tuner), random wire or balanced line and built-in dummy load. You also get a balun and 1.8-30 MHz coverage.

Special Inductor Switch

The inductor switch is the most likely tuner component to burn up.

The MFJ-949D gives you an inductor switch that's specially designed to withstand the extreme voltages and currents that are developed in your tuner.

You get a solid feel and positive click action -- not a spongy unsure feeling like some others have.

MFJ-949D **$149.95**

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You get MFJ's famous one full year unconditional guarantee. That means we will repair or replace your MFJ-949D or other MFJ tuner (at our option) **no matter what** happens to it for a full year.

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Peak and average cross-needle meter shows you forward/reflected power in two ranges (2000/500 and 200/50) and SWR. Lamp uses 12 VDC or 110 VAC with MFJ- 1312, $12.95. Flip stand, 6-position antenna switch. 10¾'' x 4½' x 15''. Add $10 s/h.

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MFJ-986 **$289.95**

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Roller inductor makes tuning smooth and easy. Turns counter lets you quickly re-tune to frequency.

MFJ's peak and average reading cross-needle meter reads forward/reflected power in 200/50 and 2000/500 watt ranges. Meter lamp uses 12 VDC or 110 VAC with MFJ-1312, $12.95. Current balun reduces feedline radiation and forces equal currents into antenna halves that are not perfectly balanced. It covers 1.8-30 MHz. Get yours today! Add $10s/h.

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Operate all bands anywhere with any transceiver with the MFJ-16010. It lets you turn a random wire into a transmitting antenna. 1.8-30 MHz. 200 watts PEP. Ultra small 2''x3''x4''.

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CIRCLE 86 ON READER SERVICE CARD

Parts List

Resistors		
R1	1k	potentiometer
R2	27k	resistor
R3	1.8k	resistor
R4	4.7k	potentiometer
R5	15 ohm	resistor
R6	22 ohm	resistor
All resistors are ¼ Watt		
Capacitors		
C1–C6	See the Table	
C7	100	pF capacitor
C8	0.01	µF capacitor
C9,C12,C13,C16,C17	0.1	µF capacitor
C10	See the Table	
C11	1.0 µF/35V tantalum capacitor	
C14	10 µF/16V tantalum capacitor	
C15	100 µF/25V electrolytic capacitor	
Coils, ICs and Misc.		
T1,T2,T3	See the Table	
IC1	NE602	
IC2	LM386	
SW1	SPST switch	
VC1	Variable tuning capacitor (three sections: 10pF, 10pF and 20pF) see the Table and the note below.	

A kit of all parts including the PC board, the TOKO coils and the tuning capacitor is available in the U.S. for $29.95 + $3 shipping from Kanga US, c/o Bill Kelsey N8ET, 3521 Spring Lake Dr., Findlay OH 45840. Tel. (419) 423–5643, 7–11 p.m. Eastern. Kanga US will supply the blank PC board separately for $6 + $3 shipping. The complete kit is also available overseas from Kanga Products, 3 Limes Road, Folkestone, Kent CT19 4AU, Great Britain.

Variable tuning capacitor VC1 is also available as part # 2311007 from A.R.E. Surplus, 15272 S.R. 12E, Findlay OH 45840. Tel. (419) 422–1558.

The TOKO coils are also available from Penstock at (800) 736–7862.

Finishing Touches

The casing and hardware for the Sudden is a matter of individual taste. The main tuning capacitor does require a vernier drive for best results. The input attenuator potentiometer, R1, must have a linear track and can be in the value range of 50 to 2.2k ohms. Sturdy wiring is required for good mechanical stability between VC1 and the board.

Tuning up the receiver is very simple. A signal generator or other low level signal source is helpful, but it can be tuned up with band signals. The first step is to get the oscillator on to the band. This may be done by connecting a signal generator to C7 and adjusting the core on T3 until the signal is detected. It is also possible to listen for the signal on another receiver. A simple wire from the receiver antenna laid over the NE602 should be enough to pick up the signal. The core, T3, is adjusted to give the best coverage of the band in question using VC1.

The bandpass filter does require a little more work. I have obtained surprisingly good results by simply peaking T1 and T2 on signals in the band. The best method is to feed a signal source into R1 and adjust T1 and T2 several times. Begin in the center of the band and peak T1 and T2 for best output. Then repeat this operation at either end of the band, ending finally by again repeaking in the center.

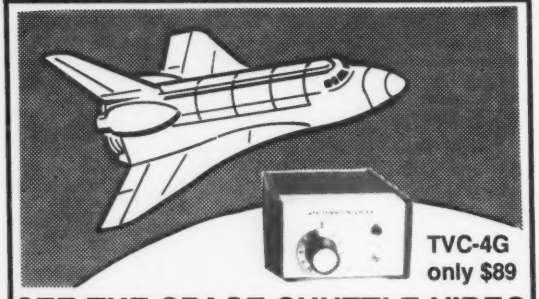
The receiver does have a conventional 50 ohms input impedance. It is advisable with such a simple receiver to attempt to match the antenna to the receiver. A good operating procedure is to turn up the audio gain control, R4, to the point where the internal noise of the LM386 just becomes a nuisance and then use the attenuator, R1, as the main gain control. This is a simple receiver, and hitting it with too much signal will bring out its worst traits.

The Sudden is capable of very surprising results for its simplicity. The morning that I am typing this text, a Sudden builder telephoned me to say he had been listening to VKs on SSB with a dipole and a Sudden on 20 meters. It is simple, it is inexpensive, and it is easy to build, but it certainly hears lots of stations. It makes a very good first receiver project or an ideal receiver for scouts or school groups.

Build the Sudden, and enjoy! 73

You can contact Rev. George Dobbs G3RJV at St. Aidan's Vicarage, 498 Manchester Rd., Rochdale, Lancs, OL11 3HE, Great Britain.

AMATEUR TELEVISION



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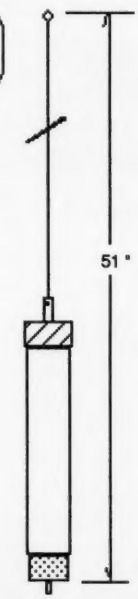

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CIRCLE 43 ON READER SERVICE CARD

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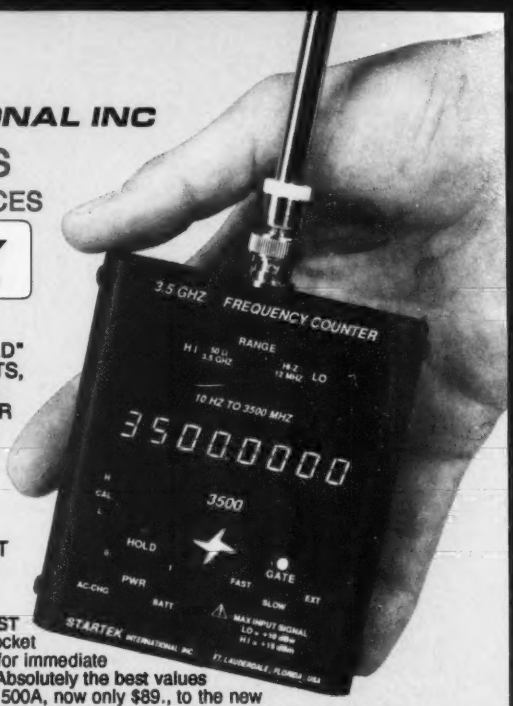

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Extend range of any counter capable of counting 16 MHZ or higher to 1600 MHZ with super sensitivity of 1-5 mV typ. 10 segment LED BAR GRAPH displays RF signal strength. StarCab™ aluminum cabinet. 110 VAC adaptor included.

MODEL AP-90
FACTORY ASSEMBLED
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FIND FREQUENCIES FAST with any of these great pocket sized counters, available for immediate delivery from STARTEK. Absolutely the best values in the industry, from the 1500A, now only $89., to the new 2500 & 3500. These new full range counters feature a 1 megohm input 10 Hz to 12 MHz, a 50 ohm RF input 10 MHz to 2.4 GHz / to 3.5 GHz for the 3500. The 2500 & 3500 both feature MMIC amplifiers for maximum sensitivity, three gate times for maximum display resolution of .1 Hz to 12 MHz and 10 Hz to 2400 & 3500 MHz, a DISPLAY HOLD switch and LED indicator to hold a reading and suspend gating until turned off. Our DISPLAY HOLD switch works properly, it does not change the GATE selection when turned off, like some competitive units. All of our counters use LSI circuitry, sub-miniaturized components and low power design for portable operation of 3-5 hours from internal 600 mA/Hr NiCad batteries. For ULTRA HIGH SENSITIVITY the 1500HS can't be beat with typical sensitivity of <.5 to <1 mV RMS from 10 MHz to 500 MHz. Our 1500A offers great quality and performance at minimal cost. All counters have a full year parts & labor limited warranty. Check out our VERY SPECIAL OFFER for any model packaged with several of our most popular accessories.

1500A ECONOMY MODEL	**1500 HS** ULTRA HIGH SENSITIVITY	**2500** FULL RANGE +HI-Z INPUT	**3500** EXT RANGE +HI-Z INPUT
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LESS NI-CADS & AC ADP	DISPLAY HOLD	DISPLAY HOLD	DISPLAY HOLD
$89.	**$159.**	**$210.**	**$250.**

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#AC-15	110 VAC adp/chgr for 1500A	9.00

■ ACCESSORIES for all models

#TA-90	Telescoping BNC antenna	12.00
#RD-800	800 MHZ Rubber Duck-BNC	29.00
#CC-90	Black vinyl zipper carry case	12.00
#DC-690	12VDC Auto adaptor/charger	9.00

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#LP-22	Probe, Low Pass/Audio use with 2500 & 3500. Attenuates RF noise.	$22.00
#P-110	Probe, freq counter or scope use, 1X, 10X. 200 MHZ scope use.	39.00

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CIRCLE 247 ON READER SERVICE CARD

A 10M Sideband Transmitter

Add voice to your QRP station.

by Bruce Auld NZ5G

Described in this article is a relatively simple, VFO controlled, double-sideband transmitter with 1 watt output for 10 meters. It's capable of easy and comfortable communications. For example, while this transmitter was still breadboarded, with its innards splayed all across my station operating table, I contacted K7EVL in Wenatchie, Washington, on the first call. He checked my signal, and he, my two-year-old Katie, and I had a merry contact.

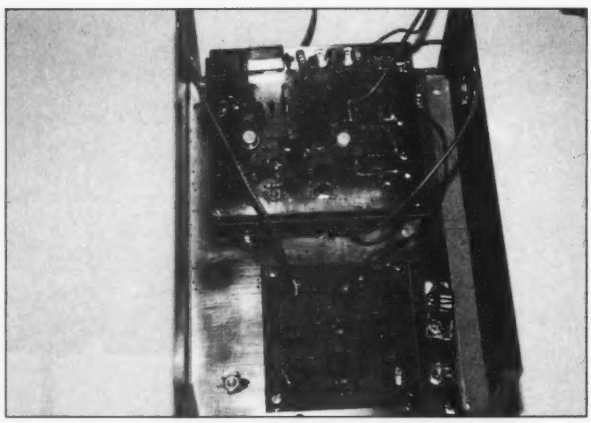

Photo A. A 10 meter transmitter you can build yourself!

The sideband transmitter is designed for hams who are interested in construction. It is also aimed at hams who are neither technicians nor engineers, but who possess some knowledge of RF construction technique. Where possible I've used commonly found parts, commonly used values, and the smallest number of different parts possible. Unless you live in a major city, however, you may have to mail-order some of them.

This project is my distillation of the excellent work of W7ZOI and WA7MLH, whose projects taught me the vagaries of sideband generation. It employs simple, known circuitry with no surprises. It is not single sideband because of the added expense and circuitry to filter the unneeded sideband. However, with plenty of room to spare on 10 meters, this is no problem. The transmitter employs a manual transmit/receive scheme so that inexpensive microphones without PTT mechanisms can be used, and it is intended to be used with the ham's existing station receiver.

The Circuit

Figure 1, the block diagram, shows the flow of the transmitter. The whole of the circuit is designed in modules and interconnected to form a team. Constructed this way, it's easier to understand and troubleshoot.

Referring to Figures 2, 3, and 4, the transmitter is centered around an 11 MHz IF. This frequency was chosen only because I had a bunch of 11 MHz crystals on hand. Any convenient combination of frequencies for the IF/VFO combination can be used to reach the 28 MHz goal. The transmitter employs the simplest form of sideband generation, a single transformer and two diodes. It is fed with audio from the mike and its amplifier, and mixed with the 17.5 MHz VFO signal. In order to place the VFO frequency as low as possible for stability, a mixing scheme was used (hence another 11 MHz crystal). For this purpose, the magical NE602 was used, which is a wonderful device. This chip is a double-balanced mixer boasting an

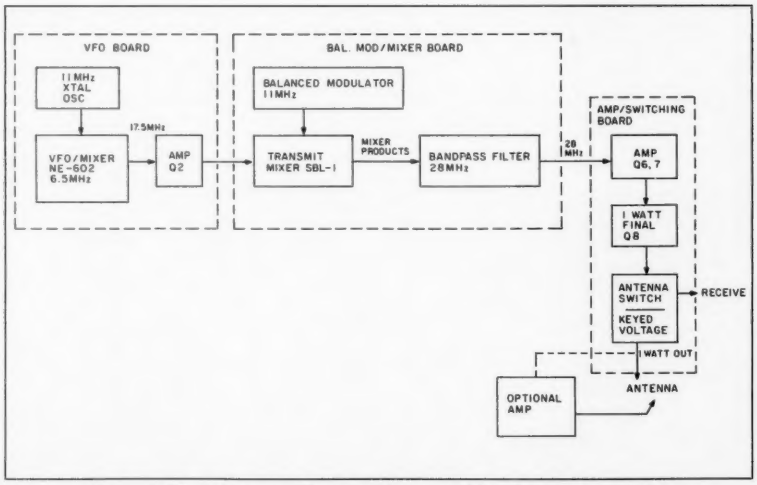

Figure 1. Block diagram of how the 10 meter sideband transmitter works.

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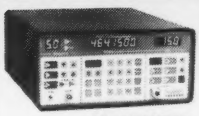
COM-3, the world's most popular low-cost service monitor. For shops big or small, the COM-3 delivers advanced capabilities for a fantatic price—and our new lease program allows you to own a COM-3 for less than $3.00 a day. Features •Direct entry keyboard with programmable memory •Audio & transmitter frequency counter •LED bar graph frequency/error deviation display •0.1–10.000 µV output levels •High receive sensitivity, less than 5 µV •100 kHz to 999.9995 MHz •Continuous frequency coverage •Transmit protection, up to 100 watts •CTS tone encoder, 1 kHz and external modulation.



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ALL COUNTERS ARE FULLY WIRED & TESTED

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CT-90	10 Hz–600 MHz	<10 mV to 150 MHz <150 mV to 600 MHz	9	0.1 Hz, 10 Hz, 100 Hz	$169.95
CT-125	10 Hz–1.25 GHz	<25mV to 50 MHz <15 mV to 500 MHz <100 mV to 1 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$189.95
CT-250	10 Hz–2.5 GHz typically 3.0 GHz	<25 mV to 50 MHz <10 mV to 1 GHz <50 mV to 2.5 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$239.95
PS10B Prescaler	10 MHz–1.5 GHz, divide by 1000	<50 mV	Convert your existing counter to 1.5 GHz		$89.95

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A real microwave Doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz, and is not affected by heat, light, or vibrations. Drives up to 100 mA output, normally open or closed, runs on 12 VDC.
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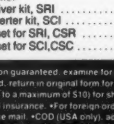

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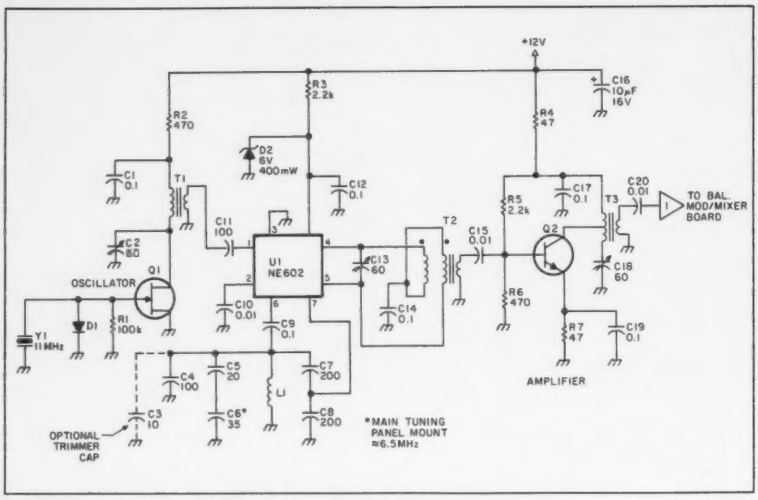

Figure 2. The VFO board.

onboard oscillator. A very respectable signal can be developed with one of these.

The signals from the sideband generator and VFO are amplified and fed into a diode-ring mixer module, U3. The jumble of frequencies that emerge go through a 28 MHz three-pole bandpass filter and a very nice 50 mV 28 MHz signal results. From here it only needs to be amplified. The next two stages are simple class A broadband amplifiers. The final amplifier transistor is the well-known 2N3553. In my unit, however, I use an inexpensive alternative, an RCA 4013 that I purchase from my friendly local parts merchant in single lots for 89 cents each. It performs equally well, and I appreciate the price more each time I destroy one experimenting.

The switching circuitry is designed to change the antenna from receiver to transmitter and to apply voltage to the amplifier chain during transmit periods. The NE602 VFO stage is free running for the sake of stability, but the carrier oscillator in the balanced modulator is normally off. This stage is switched on during transmit periods and for spotting your frequency in the station receiver. This is necessary because you would otherwise hear your carrier (though it has been suppressed) in the receiver all the time. These functions are carried out by a simple DPDT relay and two SPDT toggle switches.

Construction

The transmitter is constructed on three separate circuit boards. Their size was chosen mostly at random, but I have arranged them so that they will fit in a Radio Shack cabinet. The etching pattern and the parts placement guide are provided in Figures 5–7. The parts placement diagrams are viewed from the component side. If you use double-sided PC boards for the balanced modulator or the amplifier, be sure to rout out a space around each hole on the component side. I do this carefully with a ⅛" drill bit. Single-sided material should work just fine for these boards, however.

One may wonder why a single board is not used for this project. Briefly, I have

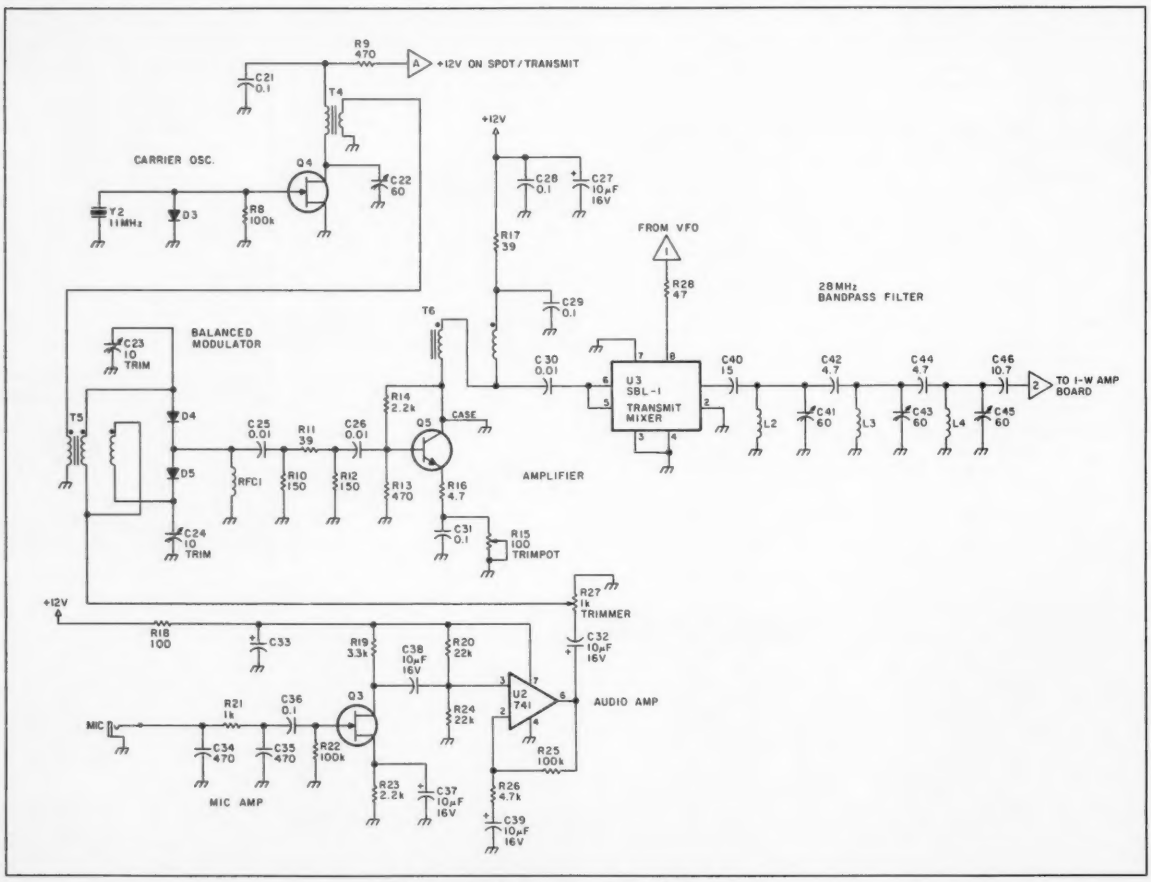

Figure 3. The balanced modulator/mixer board.

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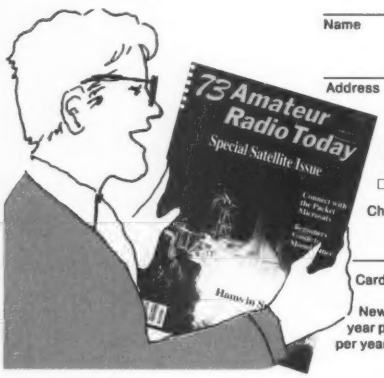

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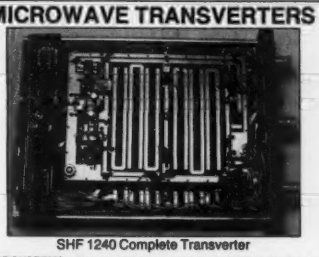

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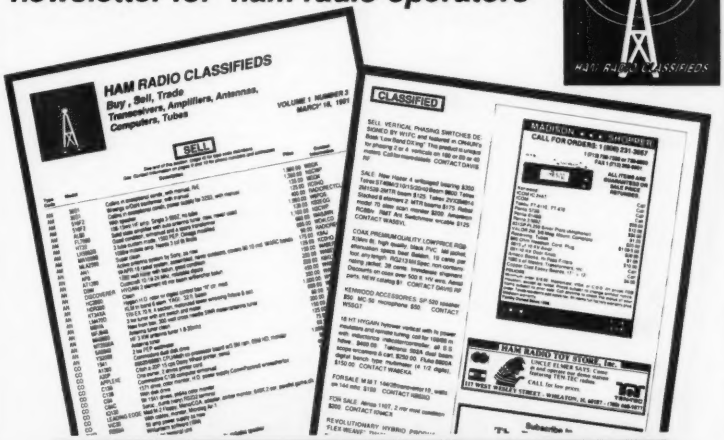

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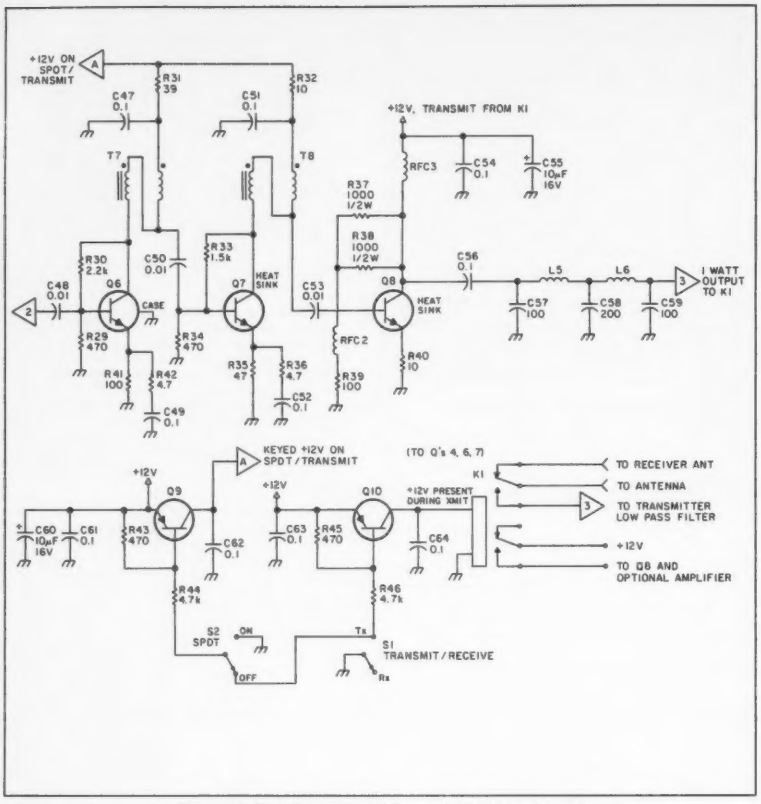

Figure 4. The 1 watt amplifier and switching board.

found that separating these stages greatly increases interstage isolation. Grounding is enhanced and a greater overall stability can be achieved.

I recommend that you build the transmitter in stages and get each stage running properly before you proceed to the next. Some hints for construction of the various modules are as follows:

The VFO

The VFO is the single most important part of the transmitter. If care is not taken to observe basic construction rules, the VFO will drift and you will be very unhappy with the rig. This PC board must be single-sided. Using double-sided board near the frequency determining components of the VFO will introduce unintended capacitance that's unstable with temperature change, causing drift. One frequently overlooked component in this regard is the tuning capacitor. Some home-brewers mounted them on a small square of single-sided board soldered vertically on the VFO board and directly behind the panel-mounted vernier dial. This mount actually forms one wall of the VFO compartment. If you follow this method, make sure the wall is not made of double-sided PC board. Of course, if you use a small aluminum box to house the VFO, this will not be a problem.

L1 lies face down on the board, glued in place after you have determined that the VFO is oscillating in the right place. I have allowed for a small trimmer for adjusting the VFO frequency, but squeezing together or spreading apart the turns of L1 will also work. Make sure that all of the parts coming off of pins 6 and 7 of IC1 are mounted as rigidly as possible.

The Balanced Modulator/Mixer

The balanced modulator/mixer board is the easiest to build and the least critical, except for the bandpass filter. Simply populate the board with parts. The spacing I have used for the pads on the board may not match your junk box parts, but I encourage you to use what you have. Notice, however, that the values for the fixed capacitors in the bandpass filter are rather specific. This stage is the most unforgiving of mistakes, and these values must not be changed casually. If you have no 4.7 pF capacitor, then try a 5 pF. Likewise, a 10 pF might be substituted for the 10.7 pF unit, but beyond that type of substitution, you may significantly affect the performance of the filter.

Note that there is a 6 dB pad (composed of R10, 11, and 12) at the output of the balanced modulator. This helps to achieve a good 50 ohm load for the balanced modulator, and the same input impedance for the following amplifier stage. Originally, I designed the trans-

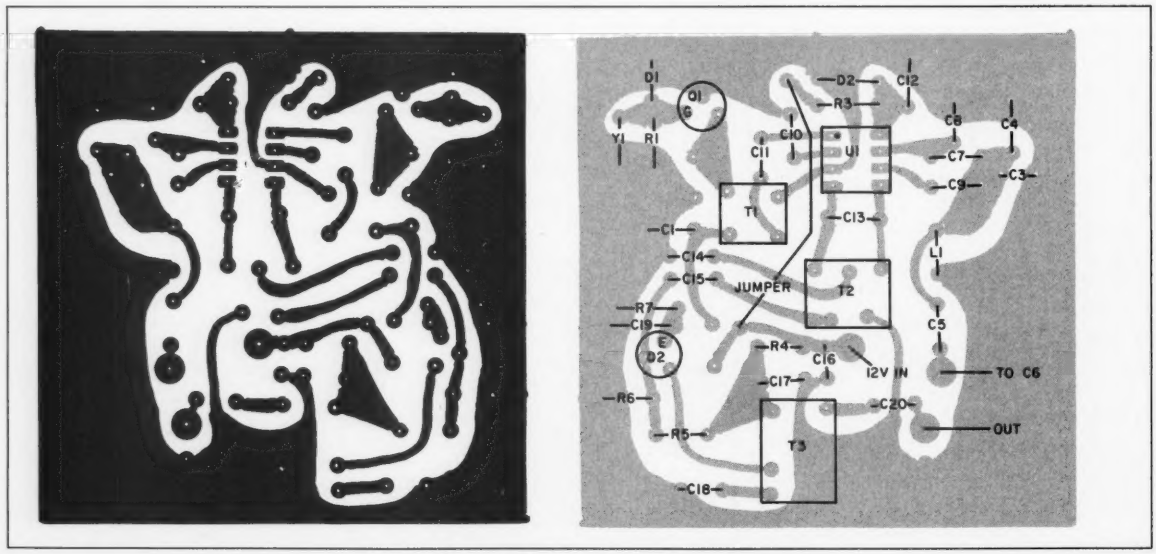

Figure 5 (a) The VFO foil pattern. (b) Parts placment.

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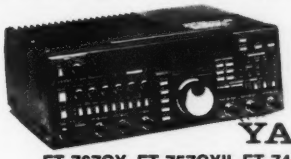

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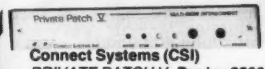

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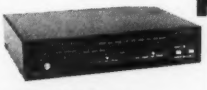

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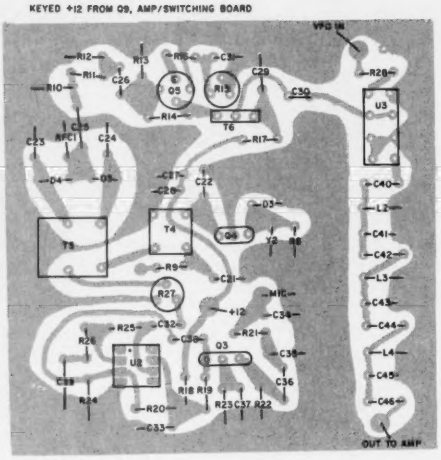
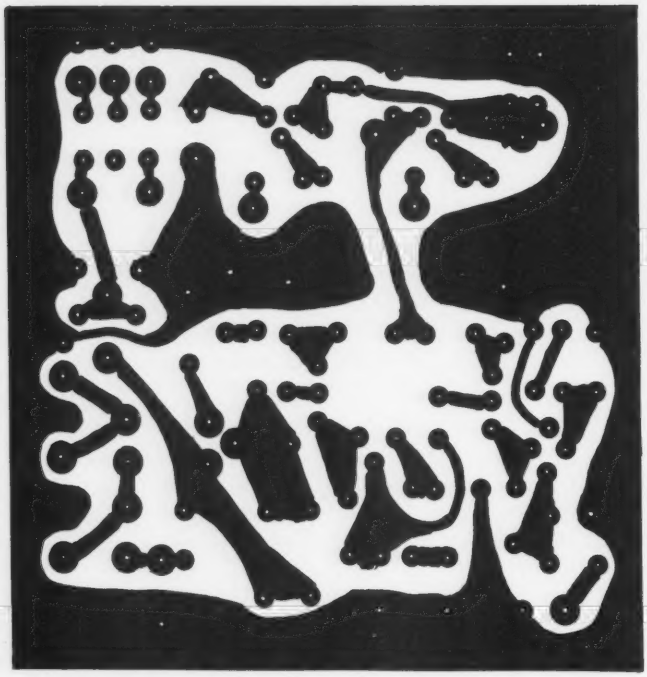


Figure 6 (a) The balanced modulator/mixer foil pattern. (b) Parts placement.



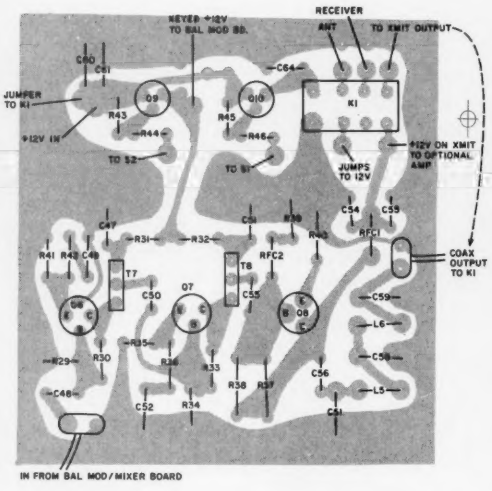


Figure 7 (a) The 1 watt amplifier/switching board. (b) Parts placement.

mitter with such a pad at the end of the bandpass filter, but found that the circuit was stable enough without it. Also, I wanted the 6 dB back! You may find that a pad at the end of the balanced modulator is not needed, and gain the energy otherwise lost heating the resistors.

The boards fit nicely into a Radio Shack cabinet. I double-decked the balanced modulator/mixer and amplifier boards on either side of a 10cm by 10cm PC board. The amplifier board is underneath because all the adjustable components are on the other board. You might consider making a cabinet of PC board material. It is drilled and cut easily, but plenty strong. If you can find a supply, you will save money on expensive cabinets. Done well, they can be lacquered or painted, and rival even the most professionally prepared cabinets in appearance. I also used a sheet of single-sided board as a false bottom in the cabinet. It helps establish a good ground plane.

Debugging and Tune-up

Viewed and constructed in modules, this rig can be assembled swiftly. Each module should be constructed and tested before moving on to the next. That way, a problem can be eliminated before it arises.

It is probably best to assemble this rig with access to a 35 MHz scope and frequency counter, if possible. If you are so lucky, your construction time will be drastically reduced.

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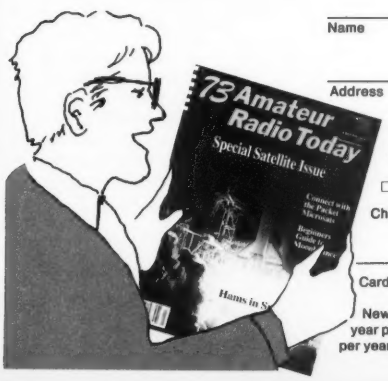

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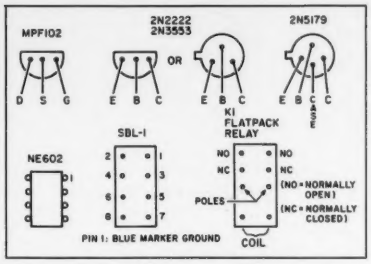

Figure 8. Base diagrams, all bottom view.

Being able to see a signal on the scope and adjust the stage in question is a big help in a sideband project where you are concerned about speech waveform. If you do not have a scope, do not despair. You can probably adjust the transmitter a little at a time with the aid of the station receiver, its S-meter, and a sharp ear. I have adjusted RF stages this way, and while time-consuming, it can be done.

Construct the VFO and confirm that it oscillates at 6.5 MHz or so. Check this by placing the scope probe on pin 7 of IC 1. Confirm that the crystal oscillator, Q1, and its associated components, are running, by placing the probe at pin 1 of IC1. Tweak the output of the crystal oscillator with its trimmer capacitor. Before adding amplifier Q2, check to see that the product of the VFO frequency and the crystal oscillator is at 17.5 MHz or thereabouts. If the counter cannot "sit still" on a frequency, the desired product is not dominant. Tweak the IC's trimmer for maximum output at 17.5 MHz. Adding amplifier Q2 and tweaking its trimmer will further preselect 17 MHz and amplify it to about 3 volts peak-to-peak.

If you have no scope, you will have to find the oscillator's signal in the station receiver. Make sure you have the receiver's antenna lead close to the oscillator for adequate pick up. Adjust the same controls mentioned above for a peak S-meter reading.

C2 sets the VFO's bandspread at about 200 kHz. I chose 28.500 to 28.700 MHz, but adding a turn or two to L1 will lower the VFO frequency to the Novice portion of the band. Eliminating C2 will greatly increase the total bandspread.

Next determine that the balanced modulator carrier oscillator, Q4, will run. It is normally off except during spot and transmit periods, so you will need to temporarily apply voltage to it through its supply line resistor, R9. Peak its output. Plug in a microphone, adjust the audio gain (trimpot R27) for maximum input to T5 (clockwise) and holler. You should hear your best Donald Duck voice at 11 MHz, double-sideband. View the sideband carrier on the scope or listen to your signal n your station receiver and adjust the carrier balance trimmers (C23 and 24) potentiometer for the greatest carrier suppression. Even at maximum suppression, you will still hear a loud carrier in your station receiver. Adjusted properly, though, it will be undetectable by other stations. I have found that the audio gain trimpot is best set at about mid-range for best voice quality. Above that, significant clipping occurs.

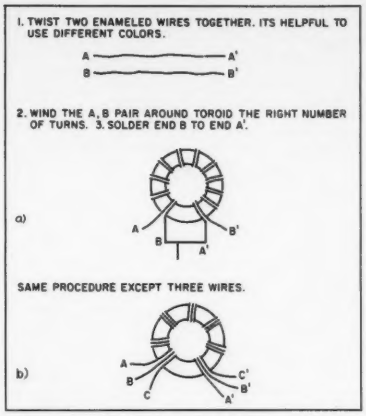

Figure 9. Winding the (a) bifilar transformer, and the (b) trifilar transformer.

The tricky part of the rig is the bandpass filter. The jumble of products from mixing the balanced modulator and VFO frequencies are all present at its input, and you must preselect the 28 MHz energy, pole by pole. Start first at the top of L2 and rotate the trimmer until you find a peak of 28 MHz waveform. Repeat this process at each pole. I have not tried this without a scope, and would expect this to be a rather frustrating part of the assembly if done by ear through the station receiver. Adjust the filter without voltage applied to the amplifier stages.

The rest of the circuit is broadbanded and not adjustble except for the lowpass filter. Final adjustment is made by tweaking every trimmer in the unit for maximum output on a wattmeter and spreading or compressing the turns on the coils in the low pass filter for greatest output. Take care that you do not

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Parts List

C1,9,12,14,17,19,28,29,31,36,47, 49,51,52,54,56,61,62,63,64	0.1µF
C10,15,20,21,25,26,30,48,50,53	0.01µF
C16,27,32,33,37,38,39,55,60	10 µF, 16V elec.
C11,57,58	100 pF
C2,13,18,22,41,43,45	60 pF "button" type trimmer
C3	10 pF or similar NPO or air variable trimmer
C4	100 pF NPO
C5	20 pF NPO
C6	35 pF air variable, panel mounted
C7,8	200 pF NPO
C23,24	10 pF trimmer, ceramic OK
C34,35	470 pF
C40	15 pF
C42,44	4.7 pF
C46	10.7 pF
C58	200 pF

R16,42,36	4.7 ohms
R32,40	10 ohms
R11,17,31	39 ohms
R4,7,28,35	47 ohms
R18,41,39	100 ohms
R10,12	150 ohms
R2,6,9,13,29,34,43,45	470 ohms
R21	1000 ohms
R37,38	1000 ohms, 1/2 watt
R33	1500 ohms
R3,5,14,23,30	2200 ohms
R19	3300 ohms
R26,44,46	4700 ohms
R20,24	22k ohms
R1,8,22,25	100k ohms
R27	1k ohm trimpot
R15	100 ohm trimpot

L1	24 turns, T-50-6 toroid
L2,3,4	13 turns, T-37-6
L5,6	8 turns, T-50-6 toriod
T1,4	Primary 33 turns; sec. 3 turns over drain end, T-50-2 toroid
T2	Primary 18 bifilar turns; sec. 3 turns over center of primary, T-37-6 toroid
T3	Primary 20 turns; sec. 3 turns over trimmer end, T-37-6 toroid
T5	10 trifilar turns, FT-37-43 toroid
T6,7,8	10 bifilar turns, FT-37-43 toroid
D1,3	1N914 or other small signal diode
D4,5	Schottky diode preferable, but 1N914 OK
D2	6V, 400 mW zener diode
Y1,2	11 MHz crystal
U1	NE602 balanced mixer/osc. IC
U2	741 single op amp
U3	SBL-1 diode-ring mixer module
Q1,3,4	MPF 102 FET
Q2	2N2222
Q5,6	2N5179 or 2N5109
Q7	2N3866
Q8	2N3553, 2SC2028, RCA 4013, 2SC2075, or equiv. transistors
Q9,10	2N4036 PNP switching transistor
K1	DPDT flatpack relay
S1,2	SPDT toggle switches
RFC1	15 microhenry molded choke
RFC2,3	10 turns, FT-37-43

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detune the bandpass filter such that it is preselecting a different VFO/balanced modulator product. I tried to avoid this possibility by choosing an IF far removed from 28 MHz. While this results in the necessity of a mixing scheme in the VFO circuitry, it made tuning the bandpass filter easy. The first attempt at this circuit employed a 24 MHz IF and 4.5 MHz VFO. This sounded great in theory, but I had practical problems differentiating between 24 and 28 MHz signals.

Beware of self-oscillation. Even these broadband amplifiers will oscillate if overdriven, or if a mismatch occurs between stages. This will result in a waveform that looks like you have a carrier present in the signal. You may look to the balanced modulator for the problem, but you may really have an amplifier oscillating. I have used many different biasing and feedback schemes for Q7 and Q8, and the resistors in these stages should not be changed casually. While it is tempting to change them to obtain more output, you may start an otherwise stable amplifier oscillating madly. Experimenting with some of these components will show what a delicate balance exists in a sideband transmitter.

Adjusted properly, your voice will sound natural in the station receiver, and the wattmeter will bounce merrily with your speech patterns, resting at zero with no speech. If your wattmeter shows a continuous deflection during transmit periods, some imbalance exists. Go through the adjustment procedure again, watching the wattmeter. You should have about a watt peak envelope power. In one version I had more, in another I had less.

The spot function is enabled by throwing S1. It turns on the carrier oscillator and enables you to tune the transmitter to your receiver's frequency without applying a signal to the antenna. Simply speak into the mike and adjust the frequency until your voice sounds natural.

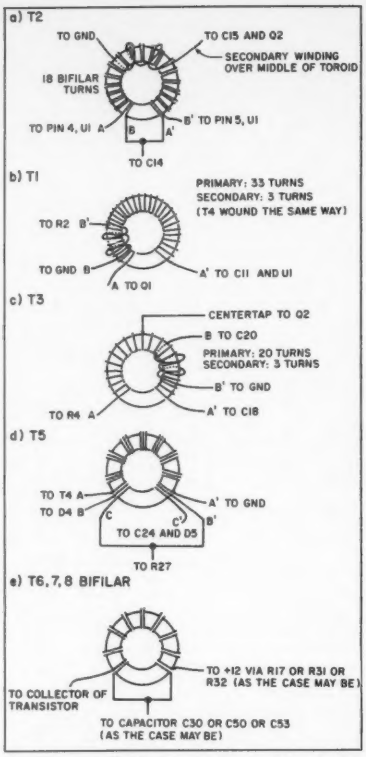
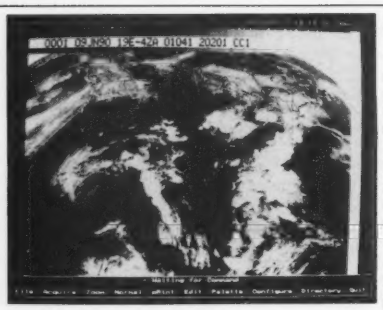


Figure 10. Winding specific toroids: (a) T2, (b) T1, (c) T3, (d) T5, and (e) T6,7,8.

On The Air!

Ten meters is wide open. After completing the breadboard version of this transmitter, I was immediately rewarded with an enjoyable 1500 mile QSO on the first call. I had the same luck the next day. I have a modest beam antenna at a modest height. You will be pleasantly surprised at what a watt will do on 10 meters. While this rig will not duplicate the performance of the commercial transceivers, it performs admirably. Most importantly, it shows that a non-engineer and non-technician, on a first attempt at a sideband transmitter, can cook up a workable system. If I can do it, so can you! I welcome correspondence regarding this rig or any home-brew topic. Happy home-brewing! 73

You may contact Bruce Auld NZ5G at 1704 Windsor Forest Trail, Roanoke TX 76262. Please enclose an SASE.



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Simple Gain Antenna for 903 MHz

Build it for under $25.

by Phil Salas AD5X

Building antennas for the UHF and low microwave bands generally requires quite a bit of metal work and some tricky adjustments to get good results. However, you can overcome some of these problems with a few relatively simple modifications to an inexpensive, commercially available TV antenna.

The antenna I used was the Radio Shack U-75 UHF corner reflector antenna (RS 15-1660), which costs just $16.95. It consists of one driven element and seven directors. (This antenna is actually called a "corner-Yagi-Uda-hybrid" antenna, which is a corner reflector antenna with directors.) The trick was to match this antenna to 50 ohms and optimize it for the 902–928 MHz ham band.

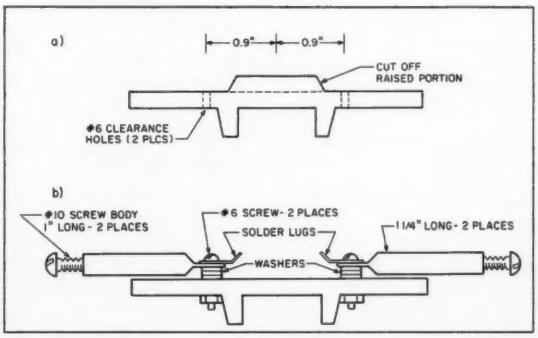

Figure 1. (a) Preparation of the plastic center piece. (b) Driven element preparation.

The Modifications

First, you must remove the insulated driven element by drilling out the center rivet holding it in place. Next, remove the aluminum elements from the insulated driven element by drilling out the two rivets holding them on. You should now be left with just the blue insulated piece. Now, referring to Figure 1(a), cut off the raised portion of this insulated piece with a hacksaw or band saw. Finally, measure 0.9 inch from the center hole and drill two holes for clearing #6 screws. This completes the modifications to the insulator.

Referring to Figure 1(b), cut two 1¼-inch pieces of ¼-inch copper tubing and flatten ½ inch of one end of both pieces. Drill a #6 clearance hole in the flattened portion on each tube. Attach these two tubes to the insulator with two #6 screws, nuts, solder lugs, and six #6 washers, as shown. Next, take two #10 x ¾-inch brass screws and insert them about halfway into the two copper tubes. Crimp the copper tubes so that the screws are snug in place. A type "F" TV connector crimping tool is excellent for this. This completes the driven element. Now, turn the screws completely into the tubes.

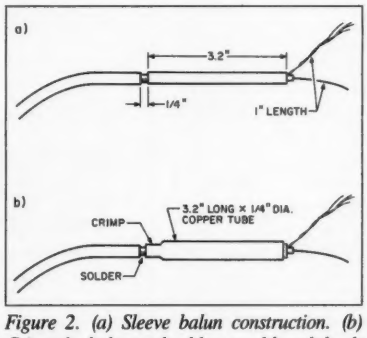

Figure 2. (a) Sleeve balun construction. (b) Crimp the balun and solder equal length leads onto the balun sleeve and center conductor.

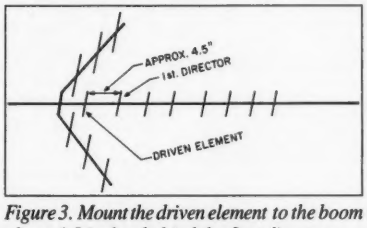

Figure 3. Mount the driven element to the boom about 4.5 inches behind the first director.

The Match

The driven element will just be a simple half-wave dipole which should give a good match to 50 ohms. However, the dipole is balanced and the coax is unbalanced so a 1:1 50 ohm balun is in order. Figures 2(a) and 2(b) show the construction of the balun. Use RG-8M coax cable (available also from Radio Shack). RG-8M is a miniature RG-8 coax which has an impedance of 50 ohms and the same diameter as RG-59. The loss characteristics of RG-8M are far superior to RG-58 and it is a perfect fit in the ¼-inch copper tubes.

Referring to Figure 2(a), prepare one end of the RG-8M by first stripping off 1 inch of insulation and exposing the braid and center conductor. Next, measure 3.2 inches more and remove a ¼-inch section of insulation, as shown. Now, cut a 3.2-inch piece of ¼-inch copper tubing and insert it over the cable, as shown in Figure 2(b). Overlap about half of the exposed braid and crimp the copper tube to hold it firmly in place. Using a 100 watt or more soldering iron or gun, carefully solder the tube to the section of braid. The open end of the tubing should be comfortably removed (0.1 inch or more) from the braid and center conductor. Now, cover the exposed braid/soldered tubing end and the entire piece of copper tubing with heat shrink tubing (from Radio Shack) and heat to shrink in place. You have just created a quarter-wave (3.2 inches at 915 MHz) 1:1 sleeve balun.

Now, solder the center conductor to the solder lug on one of the elements of the driven element assembly, and solder the braid to the other solder lug. Keep the lengths of the braid

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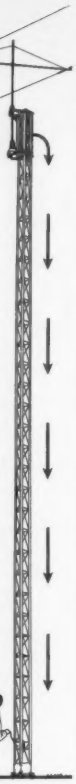

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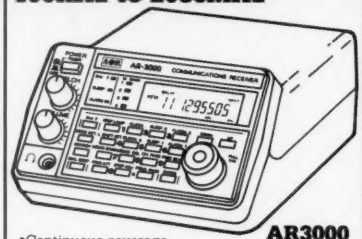

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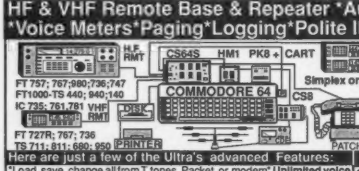

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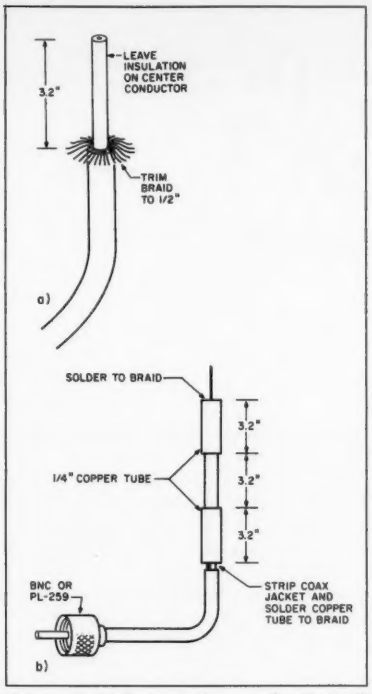

Figure 4. (a) Prepare the coax for the half-wave reference antenna. (b) Attach the sleeve and the RF choke sections of tubing as shown.

and center conductor as short as possible and equal in length.

At the other end of the RG-8M, add either a BNC or a PL-259 UHF connector. In either case, purchase a connector for RG-59 cable as it has the same basic dimensions as the RG-8M coax. A PL-259 with RG-59 reducer is the easiest connector to install. If you use a BNC connector, you will have to trim several of the center conductor strands from the RG-8M cable in order to insert the RG-8M coax center conductor into the BNC pin.

Finally—The Adjustment

To adjust the antenna, you will need a signal source and either an antenna bridge or an SWR meter. First, hold the driven element assembly out away from you and adjust the screws in no more than quarter-turn increments for minimum SWR of less than 1.5:1.

Now, place the driven element assembly on the antenna 4.5 inches behind the first director, as shown in Figure 3. Hold it in place with an 8-inch nylon wire tie (Radio Shack 278-1652). Watch the SWR and minimize it by carefully sliding the driven element assembly. If necessary, adjust the screws in the driven elements slightly. You should be able to get very close to a 1:1 SWR. Now, use either epoxy or hot glue to hold the driven element assembly permanently in place. You could also drill a new mounting hole through the boom and bolt the element in place. Also, re-crimp the copper tubing over the brass screws to make sure they stay put and make good electrical contact.

Reference Antenna

To see how much gain this antenna was really giving me, for comparison I built a half-wave sleeve dipole with an RF choke to isolate the coax from the antenna field. Figures 4(a) and 4(b) detail its construction.

Expose 3.2 inches of the INSULATED center conductor from a length of RG-8M coaxial cable. Unravel the braid and trim it to a length of ½ inch. Cut two 3.2-inch lengths of ¼-inch copper tubing. Slip one piece over the center conductor and down over the coax cable so that the RG-8M braid is under the tubing. Crimp the tubing with an "F" type crimping tool to hold it in place, and solder the tubing to the braid.

Slip the other 3.2-inch piece of copper tubing over the other end of the coax cable, positioning it 3.2 inches from the first tube. Carefully remove a band of insulation from the RG-8M, then crimp the tube over the braid and carefully solder the copper tube to the braid. Cover the entire assembly with heat-shrink tubing. Finally, add either a BNC or a PL-259 connector to the end of the RG-8M coax cable.

Attach a signal source and an SWR meter and snip off small increments of the center conductor until you have an SWR of less than 1.5:1. If you overshoot, just solder an extension wire to the center conductor and try again.

Measurements

My antenna-measuring setup consists of an ICOM R-7000 receiver with a Smith Design Spectrum Probe™ connected to the R-7000 10.7 MHz IF output. This gives me a tunable spectrum analyzer. I use a telescoping whip antenna for the R-7000 receiving antenna. Anything will work for this antenna as you are just going to look at the relative difference between the reference antenna and the corner reflector.

First, I supported the reference antenna about 20 feet from the R-7000. Then I connected a signal source to the reference antenna and made a note of the level on both the R-7000 S-meter and the Spectrum Probe oscilloscope output. Next, I connected the corner reflector and made boresight gain, side lobe suppression, and front-to-back ratio measurements. My setup is fairly crude, but I believe that the following figures are accurate to within 3 dB:

Gain:	8 dB
Side Lobe Suppression (90 degrees):	10 dB
Front-to-Back Ratio:	15 dB

An Inexpensive Solution

The gain antenna itself can be built for less than $25. Two higher gain corner reflector antennas are available from Radio Shack should you wish higher gain. The construction and set-up techniques in this article should be applicable to any of these antennas.

Contact Phil Salas AD5X at 1517 Creekside Drive, Richardson TX 75081.

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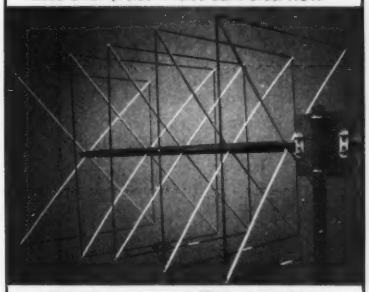

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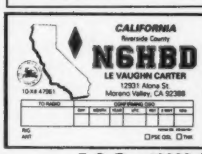

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Microprocessor Repeater Controller, Part I

Add versatility to your repeater system.

by John Bednar WB3ESS

Not long after publishing an article on my Link Controller in the December 1989 issue of *QST*, I realized just how many repeater owners needed a repeater controller they could home-brew on a modest budget. My first single-chip microprocessor repeater controller had been in operation for almost 10 years. Before offering it to others, however, I decided to completely rewrite the software to add some new features. I knew that if the design were economical, it would bring those repeater owners with diode matrix IDers and intermittent touchtone control into the 21st century.

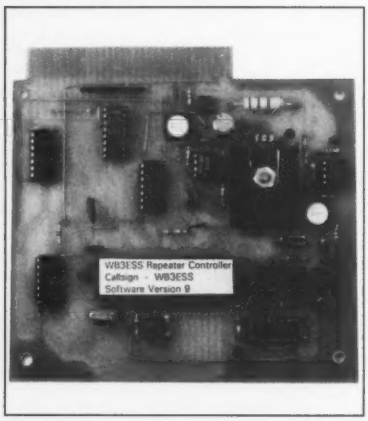

Photo A. The repeater controller consists of a computer board and an audio board. Shown above is the microprocessor board.

Selected Features

The heart of this controller is an 8749H single-chip microprocessor. To date, I am still amazed at how many features I was able to pack into it! Selecting the features required prudence, since the memory of the 8749H is limited to 2K bytes of EPROM. You could add external memory, but that would increase the size and cost of the finished product. It would also produce RFI, and you would have to mount the controller in a shielded box with feed-through capacitors to bypass the wires.

See Table 1 for a list of the features I selected. Macro capability, voice messages, reverse auto patch, and measurement of signal strength would be nice extras, but you'd spend seven to ten times more. The project in this article is for those who want an economical, easy-to-construct repeater controller with a wealth of useful features.

Overview of the Controller

The complete repeater controller consists of two circuit boards, one with the microprocessor circuits and the other with the audio and phone interfaces. With a modest junk box, you can build both of them for approximately $130. (I will be making the boards and programmed microprocessors available.) The microprocessor board (see Photo A) has nine outputs and two inputs for control and monitoring. All of these outputs are reserved for the user; they are not dedicated to any specific task.

Additional controller outputs are provided for autopatch, audio muting, repeater PTT, link PTT, and two outputs for the Link Controller Host PTT and Busy inputs. All user outputs are open collector type, able to withstand 30 volts, and sink 40 mA of current. The repeater controller has inputs for repeater CAS, link CAS, superuser, and link monitor, plus two reserved inputs for users to monitor things. All repeater controller inputs are CMOS, and offer a wide input voltage range to make interfacing easy.

Command Structure

The repeater controller has two priorities in the DTMF command structure: the "user" and "superuser" levels. None of the superuser commands can be executed when the controller is in the user mode, but all of the commands can be executed in the superuser mode. What's even nicer is that the owner can assign these priority levels to all of the 39 commands!

In most cases, you don't have to use the commands to change the CW speed, key-up delay, and hang-time available to all users. By restricting these and similar commands to superuser priority, they can not be executed unless the repeater controller is in the superuser mode.

When entering a command with superuser priority, the superuser pin must be low. If this pin input is high, only the lower priority user commands can be executed. This input pin can be connected to many different sources, the simplest being a controller output. Since output #1 is adjacent to the superuser pin, a solder ball across these two pins on the card edge connector will make the connection.

Another interesting source for the superuser input is a PL tone decoder output. With this type of connection the control operator would turn on a subaudible tone to enter superuser commands. With this type of external control of the command priority, the owner can adapt the repeater controller to whatever level of security is necessary for the environment.

Courtesy Beeps

When the repeater controller is in the non-link mode, you can choose a very short single beep, a short two-tone beep, or a no-courtesy beep. The decision to use the short single beep or the two-tone beep is based on whether output #9 is programmed high or low. I use this output to signal repeater users on whether a repeater function is on or off. By using this output to control some

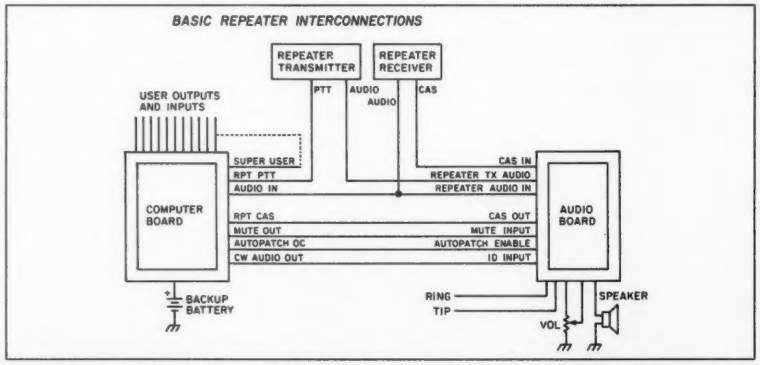

Figure 1. Block diagram of a basic repeater system using the repeater controller.

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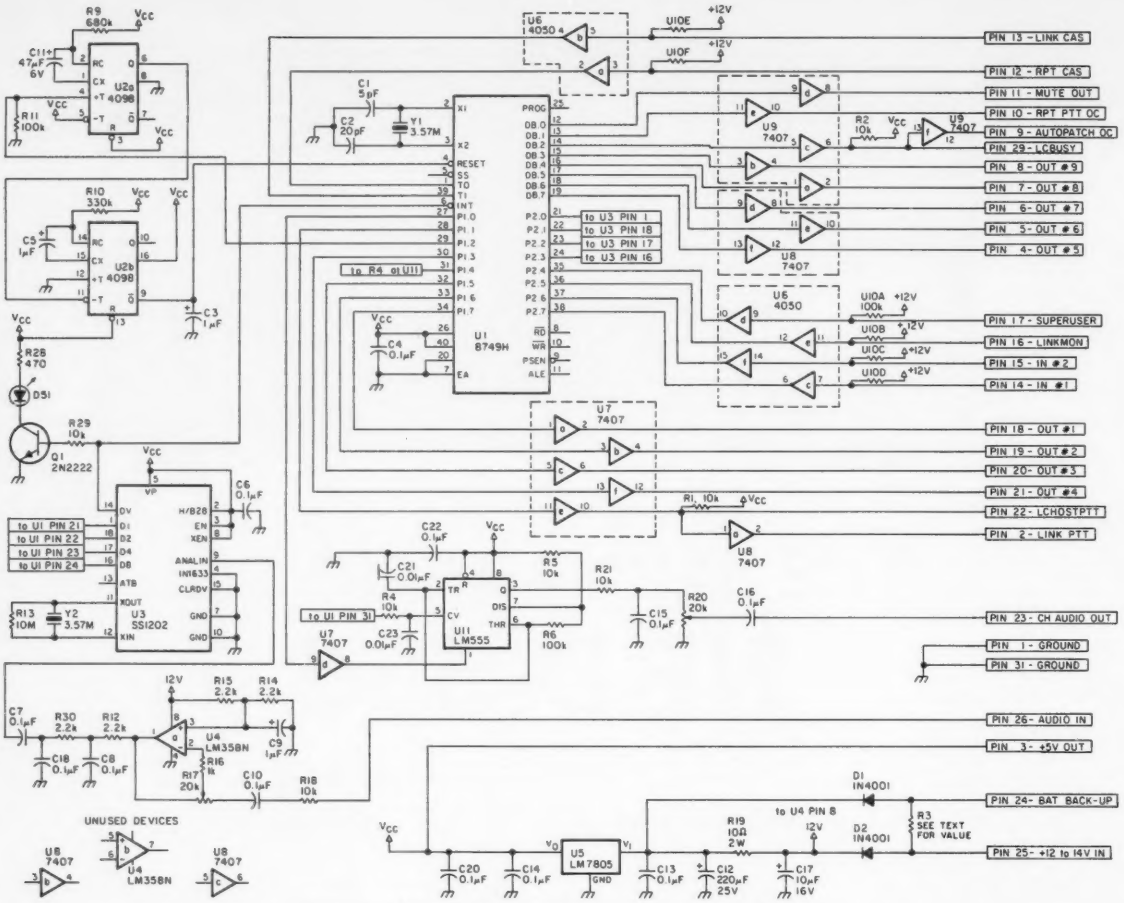

Figure 2. Schematic for the repeater controller computer board.

function, you can let your users know the on/off status of the function.

For example, you could use output #9 to turn the PL on and off. If you don't like courtesy beeps, you can simply program the courtesy beep delay to zero, and it won't sound during non-link operation! The link monitor input puts the repeater controller in the link mode via local or external control. (The repeater controller and hardware in this article is optimized for a repeater with a single link. You can add multiple links, but you have to build more hardware. I will include this information with kit orders.)

With this link monitor input, you can have an external device like a Link Controller turn the link on when a remote user wants to link into your repeater from another frequency. In link mode (linkmon input low), the computer uses an alternate set of courtesy beeps to let your users know that a link is enabled. If a user unkeys from the repeater frequency, a short double beep is sent; however, if a user unkeys from the link frequency, a dash-type beep is heard on the repeater. This simple selection of the courtesy beeps during linking operation instantly informs the users where the signals are coming from.

For additional flexibility, the pitch of the courtesy tones can be varied by changing components in the tone oscillator circuit (U11). Finally, if a user keys the repeater during the courtesy beep, the computer stops the tone so it won't interfere with conversation.

DTMF Features

Continuing with more features, the repeater controller can accept DTMF commands anytime, *even when sending CW*. When entering a command, the first digit must be valid for at least 200 ms. This is done to reduce the possibility of the controller being "triggered" by normal speech. Because of this delay, a short burst of the initial DTMF tone will be heard on the repeater, but all remaining DTMF tones will be muted.

Like the Link Controller, the repeater controller DTMF commands can be executed immediately by placing a "#" at the end of a command string. This feature can be used to control the repeater in the presence of other signals, or to string commands together. Normally, all DTMF tones are muted on the repeater and the link; however, by beginning a DTMF string with a "*" all remaining DTMF tones are transmitted over the repeater and link frequencies until the user unkeys.

This is useful for sending DTMF tones to a remote Link Controller board or some other external device. No need to worry about the initial burst of the "*" digit mixing up a remote Link Controller. Every Link Controller is already programmed to ignore invalid leading digits! Finally, an internal timer clears the DTMF digit buffer if the user doesn't unkey within three seconds of the last digit entered. This timer will aid the control operator if errors are made when commanding the repeater controller in the presence of other signals. If an error is made, the control operator simply waits three seconds and then re-enters the command.

Table 1. Repeater Controller Features

- Station ID, time-out timer, DTMF touchtone muting
- Nine outputs and two readable inputs for the user
- Programmable CW speed, hang-time, key-up delay, and courtesy beep delay
- Four-digit commands with programmable prefixes
- Programmable CW on/off read-back messages
- Programmable dual-priority level command structure
- Disable/enable repeater transmitters, link transmitter, time-out timer, and DTMF decoder.
- Autopatch and linking features
- Direct connect outputs for the Link Controller (uses commercial circuit boards and common parts)
- Multiple audio inputs and outputs with audio gating
- Phone interface, PL gating, and local speaker output
- All software, I/O, and timers are contained in one chip!

If you always thought a microprocessor-controlled repeater had to be expensive, LOOK AGAIN! You could easily spend this much just for a controller.

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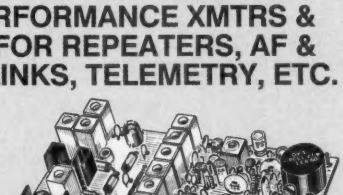

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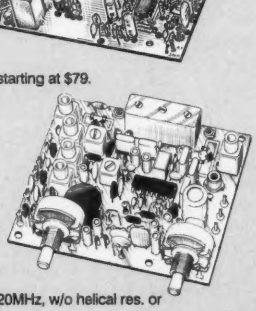

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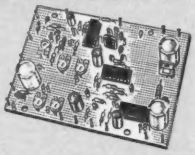

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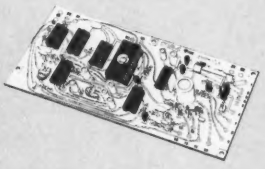
CWID kit. Diode programmed any time in the field, adjustable tone, speed, and timer, to go with COR-3 .....$59



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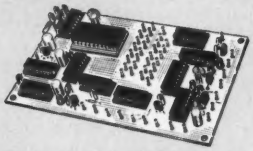

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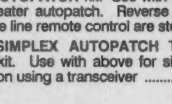

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CIRCLE 57 ON READER SERVICE CARD

ID & Timeout

The repeater controller has a fixed ID interval of seven minutes, and the repeater will ID only when nobody is talking—unless the time-out timer ID is disabled. When disabled, the repeater will ID whenever the interval timer reaches zero (while users are talking).

To save valuable memory and eliminate extra transmissions by the repeater controller, I did not program the controller to do an "end ID." This is the type of ID routine where, a few minutes after the QSO has ended, the controller sends the station callsign and sometimes an extra message. I personally like a repeater controller without lots of chatter, and that weighted my decision.

To help reduce repeater key-ups caused by intermod bursts and dialing kerchunkers, I added programmable key-up delay to the software. When the repeater is being used, the key-up delay is unnoticeable. But after 30 seconds of no activity, the controller switches to the programmable key-up delay value, which is adjustable from 0 to 2.6 seconds.

The repeater controller time-out timer is fixed at the legal maximum of three minutes. Before the repeater times out, the controller sends a message to the users with a station ID. If the user is still talking, the transmitter, link transmitter, and phone patch are turned off. The transmitters stay off until the offender unkeys and realizes his mistake and transmits again.

There is no post time-out harassment from the repeater controller; that task is left up to the repeater users. Of course, if the repeater is timed out, a control operator can enter the command to disable the time-out timer, and the repeater transmitter will come on again. To be successful, the control operator must be able to capture the repeater receiver. The "#" feature must be used.

Table 2. Commands

Command Function	Powerup Priority
Output # 1 low	User
Output # 1 high	User
Output # 2 low	User
Output # 2 high	User
Output # 3 low	User
Output # 3 high	User
Output # 4 low	User
Output # 4 high	User
Output # 5 low or pulsed	Superuser
Output # 5 high	Superuser
Output # 6 low or pulsed	Superuser
Output # 6 high	Superuser
Output # 7 low or pulsed	Superuser
Output # 7 high	Superuser
Output # 8 low or pulsed	Superuser
Output # 8 high	Superuser
Output # 9 low, two tone beep	Superuser
Output # 9 high, single beep	Superuser
Read input # 1	Superuser
Read input # 2	Superuser
Autopatch on	Superuser
Autopatch off	Superuser
Increase keyup delay	Superuser
Decrease keyup delay	Superuser
Increase CW speed	Superuser
Decrease CW speed	Superuser
Increase courtesy beep delay	Superuser
Decrease courtesy beep delay	Superuser
Increase hang time	Superuser
Decrease hang time	Superuser
Disable time out timer	Superuser
Enable time out timer	Superuser
Disposable repeater	Superuser
Enable repeater	Superuser
Disable DTMF decoder	Superuser
Enable DTMF decoder	User
Disable link transmitter	Superuser
Enable link transmitter	Superuser
Change command prefix	Superuser

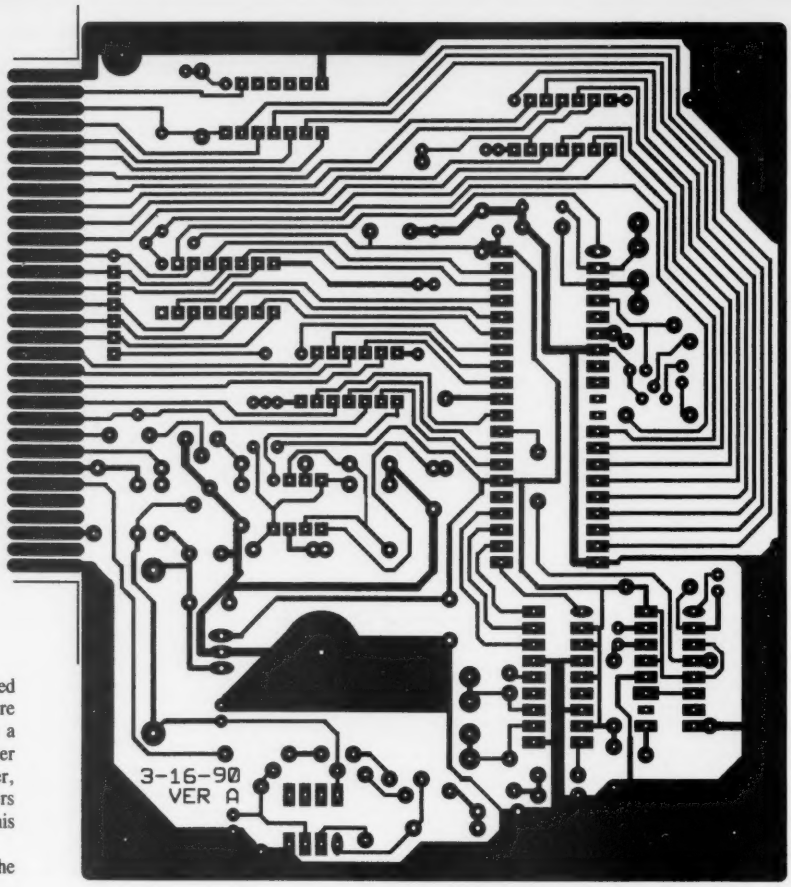

Figure 3. PC foil pattern for the computer board.

Autopatch

The repeater controller phone patch support is basic but novel. There really isn't enough memory to implement long distance lock-out, reverse patch, auto dial, or control from the phone. Despite this, the controller has several nice autopatch features.

For instance, when dialing the phone number, all digits are muted so that repeater listeners are unable to hear it. Additionally, there is an input on the computer board that allows owners to customize the autopatch with long distance lockout or a patch limit timer if needed.

During autopatch calls, the microprocessor monitors input #2. If this input is pulled low, the autopatch will be terminated as if the OFF code had been entered from the touchtone pad. Since this input is scanned only when the microprocesor is not sending Morse code, the external signal will have to be latched until the patch goes off for correct operation.

Due to some clever software, this input functions identically to input #1 during non-autopatch periods. Therefore, input #2 may be *multiplexed* for both functions. The above features, plus being able to lock out users with the superuser priority, should aid control operators.

DTMF Commands

Initially, every repeater controller powers up with the same set of default commands. All commands are fixed at four digits long, except the editing commands, which are eight digits long. Since the leading two digits of each command can be edited, unique command sets can be created.

Because the repeater controller has two command priority levels, it's not absolutely necessary to change the prefix of all 39 commands. By making the access to the superuser function unique, 30 of the commands are instantly protected from outside parties (30 of the commands power up with superuser priority).

All commands are listed in Table 2, along with the power-up priority of the command. Most of these commands are self-explanatory. The four pairs of increase/decrease commands simply change timing values in the software. The owner can use a touchtone pad to increase or decrease timer values in fixed increments. The command can be repeated to make larger changes.

I chose this method for two reasons—it keeps the operation simple and it conserves precious memory. Although it's not as glorious as pro-

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79.7 SP	103.5 1A	136.5 4Z	179.9 6B
82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
85.4 YA	110.9 2Z	146.2 4B	192.8 7A
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gramming delays in milliseconds, the result is identical. Also, my first repeater controller used this method of changing delay parameters, and it has worked well to date.

Command Editing

All of the controller commands have CW read-back to confirm the action, except for the autopatch ON command where it wouldn't make sense. To make the interfacing easier to the user inputs and outputs, I thought it would be convenient if I could control the *sense* of the CW read-back message. The power-up standard is output/input—high reads back as OFF and low reads back as ON.

If you like, you can reverse these messages when you're programming the prefix codes. Once again a simple but effective method was chosen to do this. To keep the standard read-back messages, program a 1, 3, 5, 7, 9, or A as the first digit of the prefix. To reverse the read-back messages, program a 2, 4, 6, 8, 0, #, or B as the first digit of the prefix. To eliminate the read-back message entirely, program a C or D as the first digit.

Since the "*" is reserved to pass touch tones, it can not be used as a valid first digit. If an "*" is programmed as a leading digit by mistake, simply program a new prefix with a different leading digit to correct the error.

You can program outputs #5 through 8 for pulsed low operation or a static (no pulse) function. Because of memory limitations, pulsed operation could only be added to the *output low* commands of these outputs. If a leading prefix digit of 1,2, or D is programmed, the output will pulse low for 150 ms and then return to a high state. Also, these three digits allow the owner to select one of the three possible read-back messages. If any other leading prefix digit is programmed, the output will behave like the other outputs (no pulses).

I am sure this flexibility in read-back messages is welcomed, as you don't have to invert signals in hardware to make the CW read-back message correct.

Since the above method worked so well, I decided to use the same scheme to program the command priority. To designate the command as user priority, simply select a 1, 3, 5, 7, 9, *, A, or C as the second digit of the command prefix; and as a superuser priority, select a 2, 4, 6, 8, 0, #, B, or D as the second digit.

To program a new prefix code into the controller, simply touchtone the following eight-digit sequence without unkeying: the four-digit "change command" code, and the two-digit "code number," and "new two-digit prefix." The software counts the number of digits entered, then checks the code number range. If no errors are detected, an "R" will be heard when unkeying, to confirm the change of prefix. Remember, the controller will clear the command buffer if you pause for more than three seconds between digits. If editing becomes necessary in the presence of other signals, just use the force feature "#" at the end of the eight-digit sequence.

All modifications to the power-up state of the controller are saved in the computer's RAM. Since the 8749H power-down feature wasn't usable in this design, I decided to provide battery backup power to the entire board. Everything needed for this is on the computer board, including the diode switch and the charging resistor (R3) for the battery pack. The computer board requires approximately 225 mA, so a pack of seven AA NiCd batteries will keep the board alive for close to three hours. If longer periods of backup are required, you can substitute a backup battery with greater capacity. To allow the charging circuit to function properly, the full charged terminal voltage of the battery must be at least 1 volt less than the power supply voltage of pin 25 on the card edge connector. If you notice that your computer doesn't retain programming changes after power loss, measure the voltage across R3 to see if charging current is flowing into the battery under normal conditions. For those owners who have a 6 volt battery pack lying around, a high efficiency regulator can be substituted for U5 (LM2940CT-5.0). With this regulator, the terminal voltage of the backup battery can be as low as 6.1 volts. Resistor R3 should be selected according to the battery backup scheme you use. If you power the computer board with a 13–14 volt supply, R3 should be 390 ohms (you can use either voltage regulator) when using a seven-cell AA NiCd pack; R3 should be 470–510 ohms if you use a six-cell AA NiCd pack (use the optional regulator). See the parts list for a good backup battery source.

Computer Board Operation

The heart of the computer board is the microprocessor U1. It controls the entire repeater controller. The inputs to the microprocessor are buffered by a 4050 IC (U6) and the outputs are buffered by 7407 open collector buffers (U7, U8, and U9). Pull-up resistors in a SIP resistor pack (U10) pull all the inputs to an idle state if the pins aren't connected. The board uses a 555

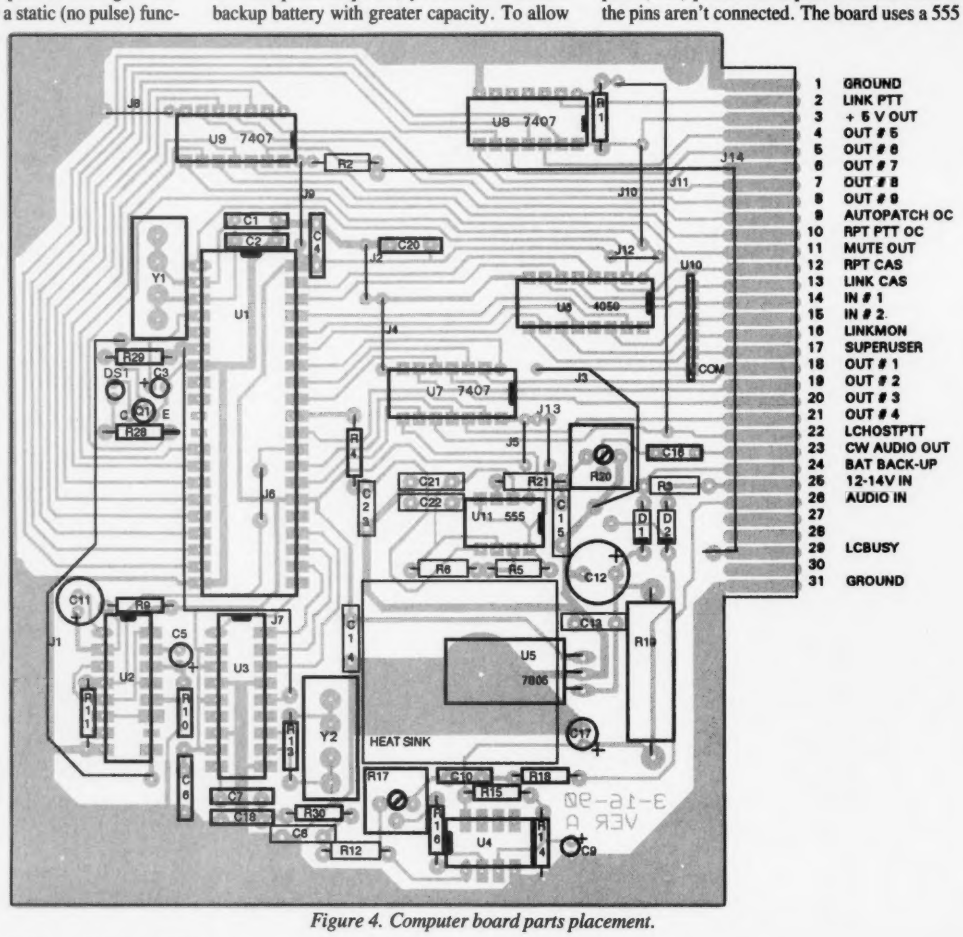

Figure 4. Computer board parts placement.

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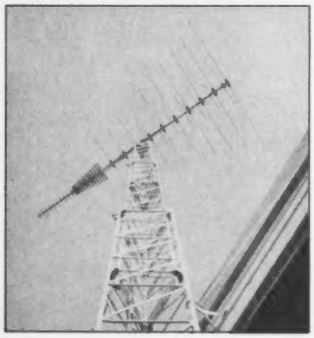

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oscillator circuit (U11) to generate the CW tones for all IDs and messages. The resistors and capacitors in this circuit can be changed to modify the waveform and frequency. To change the pitch of the tone for some IDs and courtesy beeps, the microprocessor pulls pin 31 low. Resistor R21 and capacitor C15 form an RC filter for the tone oscillator, and pot R20 is used to adjust the CW ID level.

The computer board uses a DTMF decoder (U3) and an associated audio buffer (U4) to decode the DTMF tones. The gain of the circuit is controlled by pot R17. A filter after the op amp (R30, R12, C8, and C18) rolls off discriminator audio before passing it to the decoder chip. When the decoder chip thinks it detects a valid DTMF tone, pin 14 of U3 goes HIGH, signaling the microprocessor and lighting the LED DS1. Occasionally this LED may flash briefly during normal speech. If it occurs at a high rate, the filter after U4 may have to be modified.

The watchdog circuit (U2) monitors the microprocessor and resets the computer if the program stops execution. Pin 4 of U2 is continually pulsed by the microprocessor. If the program stops execution, these pulses will disappear, and after 8–15 seconds of delay, the watchdog should reset the microprocessor. When this happens, a power-up message will be sent on the repeater, and all default commands and parameters will be reloaded into memory.

It's important to connect a DC backup source to the battery backup pin to protect the microprocessor from being reset and loading the default parameters. Without a backup battery, power supply glitches may occasionally scramble both the microprocessor and the watchdog circuit. These cases are rare and they seem highly dependent on the transient suppression of the main DC supply.

The remaining circuits on the board provide regulated 5 volts to the board. If the supply voltage drops, the backup battery will provide power to the board through diode D1. Diodes D1 and D2 form a DC switch, and resistor R3 charges the external backup battery. If a nonchargeable battery is used, this resistor must be removed.

Table 3. Computer Board Parts List

Part	Description	Source
C1	5 pF ceramic capacitor	Mouser 21FK005
C2	20 pF ceramic capacitor	Mouser 21FL020
C3,5,9	1.0 µF tantalum	Mouser 540-1.0M35
C4,6,7,8,10,13, 14, 15,16,18,20,22	0.1 µF ceramic	Mouser 140-CD12R6-104Z
C11	47 µF, 6V tantalum	Mouser 540-47M06
C12	220 µF, 25V electrolytic	Mouser 140-XR35V220
C17	10 µF, 16V tantalum	Mouser 540-10M16
C21,23	0.01 µF ceramic	140-CD50Q6-103Z
D1,2	1N4001 diode	Mouser 333-1N4001
DS1	LED, any color	Mouser 35BL501
Q1	2N2222 NPN transistor	Mouser 511-2N2222
R1,2,4,5,18,21,29	10k, 1/4 W	Mouser 29SJ250-10k
R3	see text	see text
R6,11	100k, 1/4 W	29SJ250-100k
R9	680k, 1/4 W	Mouser 29SJ250-680k
R10	330k, 1/4 W	Mouser 29SJ250-330k
R12,14,15,30	2.2k, 1/4 W	Mouser 29SJ250-2.2k
R13	10MEG, 1/4 W	Mouser 29SJ250-10M
R16	1k, 1/4 W	Mouser 29SJ250-1k
R17,20	20k potentiometer, single turn	ME323-4255P-20k
R19	10 ohm, 1 or 2 W	Radio Shack 271-151
R28	470 ohm, 1/4 W	Mouser 29SJ250-470
U1	8749H microcontroller	WB3ESS; see note below
U2	4098 IC	Mouser 511-4098
U3	SSI202 Touchtone decoder IC	Radio Shack 276-1303
U4	LM358 IC	Mouser 511-LM358N
U5	7805 voltage regulator (see text)	Mouser 511-L7805ACV
U6	4050 IC	Mouser 511-4050
U7,8,9	7407 IC	526-NTE7407
U10	100k, 10-pin SIP	Mouser 266-100k
U11	555 timer IC	Mouser 511-NE555N
Y1,2	3.57 MHz crystal	Radio Shack 272-1310
1	PC board	WB3ESS RCCB3-16-90-A
1	40-pin IC socket	Mouser ME151-8040
2	15-pin IC sockets	Mouser 15IC016
1	18-pin IC socket	Mouser ME151-8018
3	14-pin IC sockets	Mouser 15IC014
2	8-pin IC socket	Mouser 15IC008
1	TO-220 heat sink	Radio Shack 276-1363
1	Card edge connector 31/62 (mounting holes)	Digi-Key S1312
	Alternate edge connector (no mounting holes)	Radio Shack 276-1453

Parts are available from: **Digi-Key Corporation**, 701 Brooks Ave. South, P.O. Box 677, Thief River Falls MN 56701-0677. Phone: (800) 344–4539; and **Mouser Electronics**, 12 Emery Avenue, Randolph NJ 07869. Phone: (800) 346–6873.

The computer and audio blank PC boards and a programmed 8749H microcontroller chip are available for $19 each from John Bednar WB3ESS, 548 Cherryville Road, Northampton PA 18067. When ordering the programmed microprocessor, please include the repeater call as you want it sent, including the prefix (de) and suffix (/rpt) along with all spaces clearly marked. SSI 202 touchtone decoder chips are available in limited supply for $7. Please add $4 shipping for all orders. Foreign orders should include additional postage.

If you want to program your own controller IC, the source code is available in DOS format from the author at the above address. Send $10 and a formatted floppy (any size, any density). If you write the author requesting information, please enclose an SASE.

For battery backup, an assembled 7-cell NiCd AA battery pack is available from Cunard Associates. Phone: (814) 623–7000.

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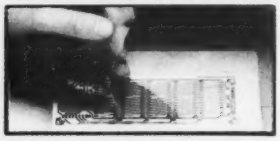

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Assembly and Test Instructions

Before you begin assembly, here are some pitfalls to watch out for:

1. Don't attempt to assemble this board with a high temperature soldering iron or gun.

2. If the LED DS1 is installed backwards, it will give you the impression that the touchtone decoder isn't working.

3. Make sure resistor pack U10 is positioned correctly, and of the correct type (one common pin and the resistors internally tied to this pin).

4. Be aware that not all the ICs are oriented in the same direction.

Begin assembly by installing the 14 jumpers. Don't miss jumper J6; it's located under U1, an IC. Follow this by adding all IC sockets. It's important to install a socket for U1 so that the chip can be removed without damage and reprogrammed if necessary. Next, install the voltage regulator and heat sink and put a little heat sink compound on the regulator tab to aid in the heat transfer. Bolt the regulator and heat sink firmly to the PC board. Finish the board assembly by adding all remaining components.

Perform the initial testing with the ICs removed. Apply 12–14 volts to the +12V IN and GROUND pins of the board, and measure the regulated +5 volts at pin 40 of U1. If the supply voltage isn't within 0.25 volts of +5 volts, measure the voltage drop across R19. If this voltage drop is greater than 4 volts, look for a shorted trace somewhere on the board. Once the voltages are correct, remove the power and insert all ICs. Reapply power and re-measure the supply voltage. With all ICs installed, it should still be within 0.25 volts of +5 volts.

The computer board sends a power-up ID whenever the computer is powered up or reset. This power-up ID can be used to check the initial operation of the computer board. Two test methods will be given; the first requires an oscilloscope and the second a voltmeter. Connect a scope probe to pin 23 of the board and apply power. While monitoring the CW AUDIO OUT pin, the CW power-up message should be visible on the scope. If no tone is observed, it's possible that the microprocessor isn't running, or the 555 tone circuit is nonfunctional. The second test method checks to see if the microprocessor is running. First connect a resistor (anything between 1k and 10k) between pins 3 and 10 of the computer board, and attach a voltmeter between pin 10 and ground. When the board is powered up, the voltage on pin 10 should drop to near zero volts. After 6–8 seconds, this voltage should rise to near 5 volts. If this doesn't happen, the microprocessor isn't running or U9 is faulty.

When the above tests are successful, the watchdog operation should be checked. Using either test configuration from above, place a 1k resistor across the crystal terminals Y1 when the computer is sending the power-up message. The resistor stops the microprocessor oscillator and crashes the program. Within 8–15 seconds, the watchdog circuit U2 should restart the microprocessor and the power-up message should be sent. If using the voltmeter technique, the voltage on pin 10 should go back to 5 volts 6–8 seconds after the computer is reset.

Next month in Part II we will discuss the audio board and operation of the whole controller.

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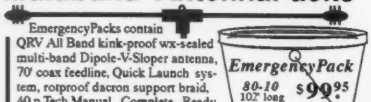

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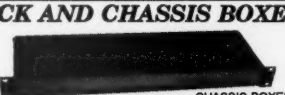

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EX-627 Auto antenna selector	315.00	**279.95**
PS-15 20A external power supply	175.00	**169.95**
PS-30 Systems p/s w/cord, 6 pin plug	349.00	**329.95**
SP-3 External speaker	65.00	
SP-7 Small external speaker	51.99	
CR-64 High stab. ref. xtal; 751A, etc	79.00	
SM-6 Desk microphone	47.95	
SM-8 Desk mic; two cables, scan	89.00	
AT-500 500w 9 band auto ant tuner	589.00	**539.95**
AH-2 8-band tuner w/mount & whip	758.00	**689.95**

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IC-275A 25w 2m w/ps • *Closeout*	$1299.00	**1129**
IC-275H 100w 2m FM/SSB/CW	1399.00	**1219**
IC-475A 25w 440 FM/SSB/CW w/ps	1399.00	**1329**
IC-475H 100w 440 FM/SSB/CW	1599.00	**1399**
IC-575A 25w 6/10m xcvr/ps	1399.00	**1199**
IC-575H 25w 100w 6/10m xcvr	699.00	**1329**
IC-1275A 10w 1.2GHz FM/SSB/CW	1849.00	**1619**

VHF/UHF FM Transceivers	Regular	SALE
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IC-229H 50w 2m FM/TTP mic	462.00	**379.95**
IC-448A 25w 440 FM/TTP • *Closeout*	599.00	**379.95**
IC-449A 35w 440FM xcvr/TTP	563.00	**399.95**
IC-1201 10W 1.2GHz FM xcvr	799.00	**719.95**

Dual band FM Transceivers	Regular	SALE
IC-3220A 25w 2m/440 FM/TTP mic	$659.00	**579.95**
IC-3220H 45w 2m/35w 440 FM/TTP	699.00	**609.95**
IC-2500A 440/1.2GHz FM	999.00	**869.95**

Multi-band FM Transceivers	Regular	SALE
IC-901 50w 2m/35w 440MHz FM xcvr	$999.00	**869.95**
UX-R91A Broad band receiver unit	389.00	**359.95**
UX-19A 10w 10m unit	299.00	**279.95**
UX-59A 10w 6m unit	349.00	**329.95**
UX-S92A 2m SSB/CW module.	599.00	**549.95**
UX-39A 25w 220MHz unit	349.00	**329.95**
UX-S94A 430MHz SSB/CW module	TBA	
UX-129A 10w 1.2GHz unit	549.00	**509.95**
IC-970A 25w 2m/430MHz transceiver	2895.00	**2029**
IC-970H 45w 2m/430 MHz transceiver	3149.00	**2729**
UX-R96 50-905 MHz receive unit	389.00	**349.95**
UX-97 1.2GHz band unit	999.00	**869.95**

VHF/UHF Mobile Antenna	Regular	SALE
AH-32 2m/440 Dual Band mobile ant	$39.00	
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Larsen PO-TLM Trunk-lip mount	24.70	
Larsen PO-MM Magnetic mount	28.75	

VHF/UHF Repeaters	Regular	SALE
RP-1510 2m 25w repeater	$1849.00	**1649**
RP-2210 220MHz 25w repeater	1649.00	**1449**
RP-4020 440MHz 25w repeater.	2299.00	**2009**
RP-1220 1.2GHz 10w repeater	2599.00	**2269**

Handhelds	Regular	SALE
IC-02AT/High Power 2m	$409.00	**289.95**
IC-2SA 2m HT	419.00	**289.95**
IC-2SAT 2m/TTP	439.00	**319.95**
IC-3SAT 220MHz HT/TTP	449.00	**299.95**
IC-4SAT 440MHz HT/TTP	449.00	**299.95**
IC-2GAT 2m HT/TTP	429.00	**319.95**
IC-4GAT 440MHz/TTP	449.00	**319.95**
IC-12GAT 1.2GHz/TTP	529.00	**329.95**
IC-W2A 2m/440 HT	629.00	**529.95**

Handhelds for Aircraft band	Regular	SALE
A-2 5W PEP synth aircraft HT	525.00	**479.95**
A-20 aircraft HT w/VOR • *Closeout*	625.00	**499.95**
A-21 Navicom Plus Aircraft HT	660.00	**599.95**

Call for information and Prices on accessories for Handhelds listed above.

Shortwave Receivers	Regular	SALE
R-7000 25MHz-2GHz receiver	$1199.00	**1029**
RC-12 Infrared remote controller	70.99	
EX-310 Voice synthesizer	59.00	
TV-R7000 ATV unit	139.00	**134.95**
R-71A 100kHz-30MHz rcvr	999.00	**869.95**
RC-11 Infrared remote controller	70.99	
FL-32A 500 Hz CW filter	59.00	
FL-63A 250 Hz CW filter (1st IF)	59.00	
FL-44A SSB filter (2nd IF)	178.00	**169.95**
EX-257 FM unit	49.00	
EX-310 Voice synthesizer	59.00	
CR-64 High stablity oscillator xtal	79.00	
SP-3 External speaker	65.00	
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Specifications
(Frequency Range 26.000-29.500)
Gain: 4.75 DB
Multiplication Factors: 12 Times
Power Rating: 2000 CW, 4000 PEP
Height: 10 Feet
Weight: 8.0 Lbs.
Materials: Anodized 6063T-6 Aircraft Aluminum Tubing
Requires 1 Coaxial Cable for Hook-up

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(Frequency Range 26.000-29.500)
Gain: Horizontal - 5.25 DB Vertical - 4.75 DB
Multiplication Factors: Horizontal - 17 Times Vertical - 15 Times
Horz. to Vert. Separation: 20-25 DB
Power Rating: 2000 CW, 4000 PEP
Height: 11 Feet
Weight: 10 Lbs.
Materials: Anodized 6063T-6 Aircraft Aluminum Tubing
Requires 2 Separate Coaxial Cables for Hook-up

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PSMB7	14.95	13.95	4.125" x 2.15" x 6.4"	115VAC	1A	1A	7A	1.6
PSMB10	16.95	15.95	4.125" x 2.15" x 6.4"	115VAC	1A	1A	10A	1.65
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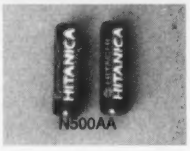


N500AA

- Sunrise
- Hitachi
- Varta

Order #	1-9	10+	Voltage	Current	Type
NRAAA	1.95	1.55	1.2V	180mA	AAA
N500AA	1.95	1.55	1.2V	500mA	AA
N1200C	3.45	3.05	1.2V	1.2 Amp	C
N1800C	3.95	3.55	1.2V	1.8 Amp	C
V5022	9.95	8.95	7.2V	100mA	216

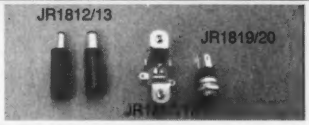
WALL TRANSFORMERS

- UL approved
- Input: 120VAC @ 60Hz
- Conn.: 2.5 mm DC Plug (except WTMT)

WTMT

Order #	1-9	10+	Voltage	Power	Weight
WT9200DC	3.95	3.75	9VDC	200mA	6.1 oz.
WT9500DC	4.15	3.95	9VDC	500mA	8.8 oz.
WT12500DC	4.95	4.75	12VDC	500mA	10.4 oz.
WT9500AC	4.15	3.95	9VAC	500mA	8.8 oz.
WTMT	5.95	5.75	3,4.5,6,7.5, 9 & 12VDC	500mA	9.4 oz.

DC POWER CONNECTORS



Order #	1-9	10+	Description	Diam.
JR1811	.50	.40	DC Plug (Walkman Type)	1.3 mm
JR1812	.50	.40	DC Plug (Mini)	2.1 mm
JR1813	.50	.40	DC Plug (Stand.)	2.5 mm
JR1817	.60	.50	DC Chassis Jack (Mini)	2.1 mm
JR1818	.60	.50	DC Chassis Jack (Stand.)	2.5 mm
JR1819	.90	.80	DC Chassis Jack	2.1 mm
JR1820	.90	.80	DC Chassis Jack	2.5 mm

LO-PRO ZIF SOCKETS

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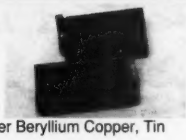

- CAM: Cast Metal
- Contacts: Spring Temper Beryllium Copper, Tin Plated
- Housing: Glass Filled Polyester, UL94V-O

Order #	Price	Description	Pins
SZ24	5.95	Zero Insertion Force Socket	24
SZ28	6.25	Zero Insertion Force Socket	28
SZ40	6.95	Zero Insertion Force Socket	40

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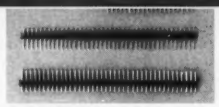
Order #	1-9	10+	Description	Contacts
EC16	4.95	4.45	Test Clip	8/14/16
EC20	6.95	6.45	Test Clip	18/20
EC24	7.95	7.45	Test Clip	22/24
EC28	8.95	8.45	Test Clip	28
EC40	11.95	11.45	Test Clip	36/40

SNAPPABLE HEADERS



- Contacts: Gold Plated
- Double or Single Row
- 90° Right Angle or Straight

Order #	1-9	10+	Description	Contacts
H401	.89	.79	Header Single, Straight	40
H401R	.99	.89	Header Single, 90°	40
H402	1.49	1.39	Header Double, Straight	80
H402R	1.69	1.59	Header Double, 90°	80

KEY SWITCH

- Key Style: Tubular
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- Mounting: 0.78" (19.2 mm)
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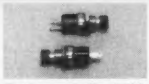
- Contact Rating: 6A @ 125VAC, 3A @ 250VAC
- Small Unit: Body Length – 0.27" (6 mm) Shorter

Order #	1-9	10+	Size
EG051S	4.25	4.05	Small
EG051L	4.45	4.25	Large

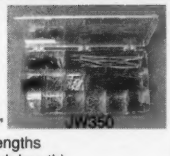
MINI PB SWITCH



- Contact Rating: 1A @ 125VAC
- Mounting Hole: 9/32" (7 mm)

Order #	1-9	10+	Desc.	Color
E1033R	.49	.39	N/O	Red
E1033B	.49	.39	N/O	Black
E1034R	.59	.49	N/C	Red
E1034B	.59	.49	N/C	Black

JUMPER WIRES

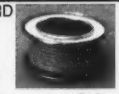

JW350

FEATURES
- 22 Awg wire
- Stripped 0.25"
- 14 assorted lengths (25 pieces each length)

Order #	1-9	10+	Description
JW350	9.95	8.95	Jumper Wire Kit
JW350R	7.95	6.95	Refill Wire Pack

22 AWG JUMPER WIRE

JW100RD



- 100 foot spools
- Single core/solid wire

Order #	1-9	10+	Color
JW100BE	4.95	3.95	Blue
JW100BK	4.95	3.95	Black
JW100GR	4.95	3.95	Green
JW100GY	4.95	3.95	Gray
JW100RD	4.95	3.95	Red
JW100YL	4.95	3.95	Yellow
JW100WT	4.95	3.95	White

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73 Review *by Michael Geier KB1UM*

Kenwood's TH-77A Dual-Band Walkie

Super-packed with features!

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FAX: (213) 604-4487.
Price Class: $600.

To paraphrase an old song. . . look what they've done to my walkie, Mah. Wow, this new Kenwood dual-bander is a true technical marvel. Slightly bigger than the single-band TH-25AT, the new rig packs 2 meters and 440 in one handy package. OK, that's not big news anymore. But this rig has more features than I ever imagined could exist in one radio. That characteristic is both its strongest and weakest point.

First Impressions

The radio feels solid and well made. Unlike the TH-25, it has a nice, easy-to-operate PTT switch. All the buttons are on the front and one side, making them easy to find. The LCD is big and shows lots of stuff, including two S-meters, tons of status indicators, and both operating frequencies at once. As on most new rigs, the final zero is not displayed, and there is just a tiny digit for a final five. The display on this radio has a very low contrast. You must look at it from just the right angle to feel comfortable with it. The angle seems well chosen for normal handheld use but, in my overhead-lit room, at least, holding it at the "sweet spot" results in glare from the room light, making it hard to read the numbers. As on the new TH-27A, the display window is convex and presents the highest point on the face of the rig, making it a target for scratches.

The buttons are rubber or soft plastic, and although many are small, they are easy to push and widely spaced. The dual-band duck antenna is completely rigid plastic on the lower half, but flexible on the top half.

The power switch is a recessed rubber button on the side, above the PTT and MONITOR buttons. Being used to the traditional rotary switch on the volume control, I wasn't wild about this idea at first, but I have come to like it. The button is quite stiff, making it unlikely that it will be turned on by accident. Besides, you must hold it in for a significant fraction of a second or it won't work, further reducing the likelihood of accidental operation.

On top, there are dual concentric volume and squelch controls, one for each band. There's an oddity here, though: the main and subbands volume controls can be swapped depending on which band you are transmitting on, but the squelch controls stay fixed. It is easy to wind up with VHF volume and UHF squelch on one control, with the situation reversed on the other! It's not serious, but it can be confusing. Since squelch tends to be a set-and-forget operation, perhaps it would be better if the squelch controls were small, recessed knobs on the back of the radio. Overall, the rig feels like solid, professional gear in your hand. It has a nice, inviting quality to it—you just want to pick it up and talk into it.

Photo. The TH-77A, Kenwood's compact dual-bander.

Pick a Feature, Any Feature

Let's see. . . we've got 42 memories, DTMF autodialing, simultaneous receive on VHF and UHF (or on two UHF frequencies at once!), CTCSS, DTMF paging and calling, Automatic Band Change, dual LCD S-meters, a direct DC power jack on top of the rig, the ability to route the two bands' receive audio to separate speakers, crossband duplex operation, and all the now-standard features like scanning, automatic and variable offsets, and so forth.

Unusual features include the above-mentioned ability to monitor two UHF frequencies at the same time. Note that I am not referring to "priority" watch operation (which the rig also has), but to actual full-time simultaneous receiving. Apparently, the second UHF frequency is monitored through the VHF front end, though, because the manual warns that in this mode the second frequency will exhibit reduced sensitivity. But what the heck, it still could be useful in a major metropolitan area like L.A., where UHF activity is extensive. The rig cannot simultaneously monitor two VHF frequencies; I guess the UHF front end can't be tricked into receiving VHF.

Other noteworthy features include the DTSS, or Dual Tone Squelch System. This system allows you to monitor a busy repeater without having to listen to the chatter, yet be called via a three-digit DTMF sequence. Also available is a paging function, which is somewhat similar to the DTSS but provides for both personal and group codes and also displays the calling station's ID code. There is a limitation to these features, which I'll discuss later on.

The LCD S-meter functions as a battery level meter on transmit (a nice touch), and the rig uses the batteries and most accessories from the TH-25 and '26 series. It includes a belt clip and two nifty covers. One slips on the bottom of the rig when you power it from the external DC jack on top and have no battery connected. This arrangement makes for very nice mobile operation, because all the cables exit from the same place and there is no exposed connector on the bottom. In this configuration, the entire radio is about the size of a microphone!

The other cover slips over the keyboard, protecting it from scrapes and damage. A flexible button is provided so that you can operate the FUNCTION key without removing the cover. By the way, the keyboard is backlit along with the LCD, and the lights can be locked on, making the rig much easier to use in the car at night. The lights are all LEDs (thank goodness, no more incandescent bulbs), so you don't have to feel guilty leaving them on for long periods. Naturally, you won't want to do this when using batteries, because the battery life will be significantly shortened.

Basics

As delivered, the radio receives from 136.000 to 173.995 MHz and 438.000 to 449.990 MHz, and transmits from 144.000 to 147.995 and 438.000 to 449.990. Interestingly, Kenwood's ads for the rig specify that it can receive 118–136 MHz AM (aircraft) after modification, but there's no mention of it in the manual.

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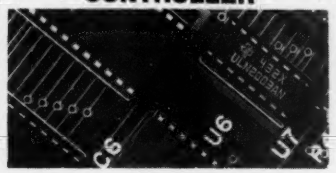

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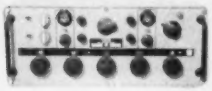

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CIRCLE 89 ON READER SERVICE CARD

MY GAP CHALLENGER DX-VI

Lew McCoy, W1ICP
CQ Technical Editor
(March 90 Review)

..."could actually hear signals that were in the noise on the beam. In my comparisons between the base-fed vertical and the GAP, the GAP consistently outperformed the base-fed antenna. Most of my reports were approximately one s-unit better with the GAP. One other surprise was that the GAP vertical was quieter (less noise) than the two base-fed verticals. I would rate the GAP as a quality product, but even more important a good performer."

Richard Morrow, K5CNF
73 Magazine
(October 90 Review)

"another very good thing about the GAP antenna is that you don't have to tune it. Usually broadband antennas are not very efficient, but this one is. If I could have only one antenna, I would definitely rather have this one. The lack of lossy coils, and the coverage of a very wide part of 75 meters by an all band vertical, impressed me more than a little!"

Kurt N. Sterba
Worldradio Magazine
(February 91 Review)

"These guys have solved a problem associated with verticals. That is, an awful lot of RF is wallowing around and dropping into the dirt instead of going outward bound. How does it perform? Like a hot knife through butter. I was just a barefoot boy answering the CQ callers. They just kept coming back to me. POW! POW! POW! I am almost struck with disbelief myself. I mean, this is a vertical. But then, it's a vertical with a big difference. I was indeed pleased. If I were a whole lot younger and I had two of those GAPs phased, I'd tell those contest hotshots to . . . look out!"

CIRCLE 172 ON READER SERVICE CARD

There is a mod which will enable aircraft RX, crossband repeat, and even reception of some other non-ham bands. Naturally, you're not supposed to do it, but also naturally, the procedure is already floating around. When will they ever learn that we hams don't like secrets kept from us in our expensive purchases? If they didn't want us to do the mod, they either should have made the advertised aircraft band RX a standard feature or not advertised the capability in the first place.

As on most of the new miniaturized walkies, the speaker is small and somewhat tinny, and there's not a great deal of audio output. It's not bad at home, but it can be hard to hear the rig in a noisy car or pickup truck. I can't fault Kenwood here; that's just as good as it seems to get from a speaker that small. The transmit audio is crisp and clean, as is usual in Kenwood rigs. The mike is somewhere inside the speaker cutout, but I can't see it on this radio. It doesn't matter; if I talk at the speaker hole, it transmits fine.

Receiver sensitivity seems good, even outside the ham bands. The included dual-band duck antenna is something of a compromise, especially on VHF, but the result is certainly adequate. Even so, the NOAA weather station on 162.400 MHz comes in better than it does on my other HT with a single-band antenna. The selectivity is typical of Kenwood rigs, being OK but not real sharp. It can be hard to tell when you're 5 kHz off.

Renaissance Radio

I love high-tech toys and, up until now, I've always felt that the more features, the better. But this rig may finally have gone too far. No question about it, it does everything and then some. In fact, it has features I've never even thought of, some of which are slick and useful, and others which seem pointless to me. Let's look at a few:

You can select which band will be heard when you press the MONITOR button to open the squelch. There are three options: main, sub or both. You can change the sequence of some of the keys, such as the CALL/C SCAN key, so that they perform different functions in different orders. You can select CTCSS independently on each band. In addition to the usual VFO scan limits, you can set VFO tuning limits which will prevent you from tuning the VFO outside them. (Since you are already protected from *transmitting* out of band, I can't imagine why you'd want to do this.) You can select whether or not you want the rig to stay keyed while you manually send DTMF, even if you let go of the PTT. There's even a choice between two beeper sounds for the tone alert function. You can reset the VFO and memories independently to default condition. You can swap the main and subbands, and also select full-duplex crossband operation, listening to one band while you talk on the other! Using this feature, it is even possible to converse telephone-style, continuously transmitting while listening. (You'd better have a big battery and wear gloves, though, because continuous transmitting will drain it fast, and the rig will get quite hot.) You can select from eight scanning modes. And on and on... there seems to be no limit to the hoops you can make this thing jump through.

Strike Up the Bands

Managing two bands at once makes for some interesting control requirements and possibilities. For instance, memory management can be handled in several ways:

You can select a memory between zero and nine with one key press and then rotate the tuning control to get at the other 30. Or, you can split them into VHF and UHF. Or, you can select any memory with two key presses. Finally, there's "page recall," in which you can have it search through four banks of 10 memories each, looking for any memory with the same digit you entered, as long as it's on the same band. So, if you press "4," it will find memory 24 if it is on your selected main band. (If it sounds complicated here, believe me, it is even worse in the manual. But more about that later.)

Tidbits

I noticed several interesting operating characteristics, some of which I couldn't find in the manual. For instance, the output power level setting (HIGH, MEDIUM or LOW) follows the band. Thus, if you set the rig to LOW while transmitting on VHF, and then swap the bands, the output indicator will revert to whatever it was on the other band, and will come back to LOW when you swap back to your original band. It's a nice touch. Too bad the indicator, which is only active for the main band, is shown under the subband's frequency on the display, making it confusing.

The scan speed is medium, being quite a bit faster than that on older rigs, but nowhere near as fast as some other HTs. Also, as on most rigs, the scan stops when the squelch opens, which generally is not on the center frequency of the transmitting station. This, combined with the rig's only fair selectivity, causes the scan to stop three times on each station, with only the second time being on the right frequency. (It also makes the carrier-operated scan stop mode useless for VFO scan, because it will freeze on the wrong frequency and sound distorted.) It is a simple matter to examine the output of the FM detector for DC bias and stop only when it is zeroed in on the right frequency. I wonder why nobody does it; it would be a great improvement.

The S/battery meter displays have 10 steps each but, like the TH-25, they always move in groups of two, so they are really five-step displays.

The radio can be used as a crossband repeater, but not without the modification. Crossband repeat is something people actually use now and then; I wonder why they didn't make it standard.

The battery saver and automatic power off modes can be turned on and off but not adjusted for their time periods. The APO operates after 59 minutes, and there is no mention of the duty cycle of the battery saver. In general, it works well and you should only want to turn it off for packet, DTSS or paging operation.

The tone alert starts a timer which shows

you how long it has been since the call was received.

Making the Complex . . . Complex

The problem is, the presentation of all these wonderful features is truly intimidating. I fully realize that having so much to offer results in some hard choices regarding key press sequences and such, but the interface as well as the key labeling is confusing. For instance, there are the AL, S.CT, M.CT, S.DT, M.DT, C.SEL, U.CHG and UXU keys. Do you really expect to remember what any one of them does? Better mnemonics could have been helped. And the display shows ABC, DUP, DT, CT, TX.S, L, M, R, AL, C, another M and others.

There are various combinations of key presses which seem to make no sense. For instance, to change memory banks, you press the LAMP button along with a digit. Why the LAMP button? And you press the M key and then the MONITOR button (which normally opens the squelch) to enter phone numbers into the DTMF memories. The SCAN key lets you set codes in paging mode. And so on. I know I can't remember sequences such as these, because they have no discernable patterns.

Some rigs have default settings which you select by holding a key while you turn the power on. This rig has *twenty* of them! Most of them are things you won't want to change very often, if at all, but a few can get you into trouble if you forget what they do. And, while some have an indication on the display, some don't. For instance, you can change the delay time before the dual-tone squelch system sends its tones by holding the MHz key and turning the power on. Doing the operation twice causes two different beep tone sequences to sound as the extra delay apparently turns on and off. But nothing shows on the display, so I have no idea what is actually happening, and the manual gives no hint either, because the meaning of the two tones is never discussed.

By the Book

And that brings us to the documentation. Yes, it is fairly complete but, like so many of these booklets, it is written in Jenglish and contains such gems as "use of earphone causes no howling" ("to avoid howling, use an earphone"); and my favorite, "During A.B.C. operation, being exchanging the bands each other" (??? no idea). There are plenty more of these. It's hard enough trying to learn a complicated rig without struggling to decipher incomprehensible language.

I don't mean to suggest that you can't learn to use the rig from this manual; you can. But it is dense reading and will take awhile. To its credit, Kenwood has included a full set of schematics. But the microphone hookup diagram on page 8 of the manual shows a wire with an arrow going nowhere. If you're a technical type, you can probably figure this out from the rest of the diagram. If not, good luck.

A rig this complex and difficult to use needs a wallet-sized "cheat sheet" card. Most new rigs include them, but this one does not.

Tough as this rig is, there is a way you can enjoy it without killing yourself. All you have to do is preset most of the functions once and then memorize only the subset of commands you will use on a daily basis. Apparently, this is what many hams are doing. Here is a report from Greg N4PSA in Miami, who has owned his TH-77A for several months:

"Having purchased the TH-77A in January makes me the local Elmer, so I have been helping folks out with their questions. One overriding complaint from the '77 crowd is about the manual. Actually, all of the functions and features are described, but not clearly.

"During the requisite learning stage of '77 ownership, I saw that the paging function would not work through most of the local repeaters, since they mask transmitted DTMF tones for security purposes. Although some repeaters will pass the tones, they usually must be preceded by sequences which include the # or * to disable the masking function. Unfortunately, the TH-77A does not allow those codes to be sent; it permits only the digits 0–9. This limitation makes the paging feature inoperable in most big cities, where it would be most useful.

"After familiarizing myself with the rig and all of its capabilities, I found that I really only used a small portion of the features. In the end, I left most of the options set up at the factory defaults. It sure would be nice to have a wallet-sized function guide card. I do like the rig, though. It's small, it's light, and when you need to make changes, the flexibility to do so is there . . . but don't lose the manual!" 73 de N4PSA

Get the Bug Spray

Any radio this new and advanced is bound to have a few bugs, and the TH-77A is no exception. Here are some I've found, or heard about and verified:

Kenwood's ads show the upper VHF frequency limit as 165 MHz. Although the radio actually tunes nearly to 174 MHz, the frequency synthesizer won't lock reliably above about 168 MHz. You can tell when it's out of lock because the rig beeps about once per second. The first time it did that, I had no idea what it meant, because it isn't mentioned in the manual.

Several people have reported problems with losing all the memories if they let the battery get low enough to cause the display to flash. Apparently, once it starts flashing, the rig refuses to respond to the power switch, so you can't shut it off. Eventually, the memories get trashed. Naturally, there is an internal lithium battery which is supposed to prevent this sort of thing, but something goes wrong and it doesn't kick in under these circumstances. Greg advises that the cure is simple: If the display flashes and you don't have other power available, remove the antenna (so you won't receive anything) and battery pack, and let the pack sit for about 20 seconds. Then put the battery back on. It should have recovered enough to let you turn the rig off.

There's an option which lets you send either band out to an external speaker while listening to the other band on the internal one. If you select this option but don't plug a speaker or

Continued on page 47

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CIRCLE 172 ON READER SERVICE CARD

Low-Pass Antenna Tuner

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by J. Frank Brumbaugh KB4ZGC

Most commercial and home-brew antenna tuners use essentially the same T-circuit—two variable capacitors in series with the RF, and a tapped or rotary inductor from the junction of both capacitors to ground. Obviously, this circuit works well. It can transform a wide range of impedances to match the nominal 50 ohm output of modern solid-state transceivers over a broad frequency range, from 160 or 80 meters through 10 meters.

However, it also has some disadvantages. It is a high-pass filter configuration and does nothing to reduce the amount of harmonic energy reaching the antenna. Construction is somewhat complicated in that both capacitors must be insulated from the cabinet. Under some impedance matching conditions, the set screws in the control knobs can "bite" your fingers with RF. Also, the cost of high quality variable capacitors and the difficulty of finding them today is discouraging.

There is a simple way of eliminating all these disadvantages while retaining the wide frequency range and impedance matching ability. This circuit is not new—it has been used by a few hams for years—but for some reason it has not received the publicity in ham literature that it deserves.

The Circuit

See Figure 1. This low-pass antenna tuner schematic retains a simple T-configuration. Now, however, the circuit forms a low-pass filter that reduces harmonic energy falling in the television channels by up to 20 dB. Only one variable capacitor is used, and its rotor is grounded, eliminating the possibility of RF biting one's fingers. A center-tapped inductor is in series with the RF, and the center tap is connected to the stator of the shunt-tuning capacitor. Both sections of the series coil are tapped every two turns, and the taps are selected by a pair of rotary wafer switches mounted directly to the grounded panel.

Theory of Operation

Selecting various coil taps with the rotary switches and varying the setting of the variable capacitor, much in the same way the standard tuner is adjusted, changes the operating frequency and impedance transformation ratio. This makes it possible to tune out any reactance, bringing the SWR down to 1:1, keeping the transceiver—and its owner—happy.

Because one tap point on each switch is connected to the center tap of the inductor, it is possible to change the circuit from a T- to an L-circuit with a choice of inductive or capacitive input. This lets you use the tuner with low or high impedance end-fed antennas, including random wires. This feature, impossible to achieve with the standard T-circuit, is handy for Field Day, and could be invaluable in emergency operation with a makeshift antenna.

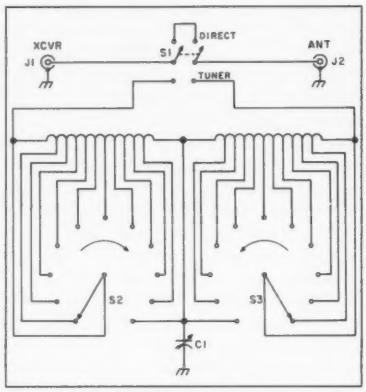

Figure 1. Schematic for the low-pass antenna tuner.

Construction

A shielded metal box or an enclosure made of printed circuit board material should be used. However, this tuner will function equally well "in the open" on a breadboard. Because this unit is designed for the 3–30 MHz range, lead lengths are relatively unimportant.

A single length of air-wound inductor (Barker & Williamson or Airdux) with a total inductance of 35 to 40 µH, or a pair of tapped toroids (T106-2 or equivalent) will work equally well in this circuit. Both coil stock or toroid cores should be chosen with the power level of your rig in mind, of course. I use a Kenwood TS-440S "barefoot," so I chose a "50 watt, 80 meter" plug-in coil of the 5-pin type common in the 1940s and 1950s, which I found at a hamfest for 50¢. It has an inductance of about 17 µH each side of the center tap—34 µH total. It is tapped every two turns.

The shunt-tuning capacitor should have a plate spacing of at least 0.05" for use with the usual 100 watt transceiver. The two wafer switches are ceramic, single pole, 11-position, with shorting contacts. I used a surplus 140 pF tuning capacitor from a BC-610 tuning unit, another hamfest prize purchase. However, a 100 pF capacitor should be sufficient.

The parts layout can be whatever the builder prefers, though the logical arrangement is to mount the wafer switches in a horizontal line on the panel, with the capacitor mounted between them, or slightly above or below the wafer switches.

A miniature DPDT toggle switch, rated 6 amperes at 120 VAC, is included for ease in inserting or bypassing the tuner in the transmission line. This is not required, but it eliminates unscrewing and rescrewing a lot of coaxial jumper cables when changing from using the tuner to feeding the transmission line directly.

Finding the Parts

Check out your junk box. Ask local hams and at your next ham club meeting. Scrounge the flea markets at hamfests. These are the cheapest ways of getting the coil and capacitor.

If all else fails, suitable air-wound inductors are available from *Surplus Sales of Nebraska, 1315 Jones, Omaha NE 68102.* Suitable variable capacitors are available from *Fair Radio Sales, P.O. Box 1105, Lima OH 45802.* Radio Shack and numerous mail order electronic parts dealers can supply a metal enclosure, knobs, wafer switches and RF connectors. *Radiokit, P.O. Box 973, Pelham NH 03076 (603) 635-2235* is another good source of wafer switches, coils (B & W Airdux series) and large variable capacitors. The capacitor plate spacing and the size of the coil will depend on the amount of power you wish to run through the tuner. For example: If you are running under 100 watts try using Radiokit coil # 1606T or 1608T (2" diameter B & W Airdux) and variable capacitor #21140 (Millen) or #149-6-1 (Cardwell).

Parts List

C1	100 to 150 pF variable capacitor, 0.05" spacing.
J1, J2	SO-239 or other RF connector.
L1	35-40 µH coil, center-tapped.
S1	DPDT toggle switch.
S2, S3	Single pole, 11-position ceramic wafer switch, shorting contacts.

Operation

Connect the low-pass antenna tuner between the antenna transmission line and an SWR meter which is connected to the output of your transceiver. Set C1 to half

Continued on page 73

Continued from page 45

earphone in, the "external" band does not revert back to the internal speaker. It just disappears! The rig was set to this mode when I got it and I thought one band was broken. It took me quite awhile to unravel the mystery.

Suggestions

The SHIFT/REVERSE button should have its functions exchanged, so that reverse could be selected with one key press. You don't change the shifts all that often anyway, so it would be fine for them to require use of the FUNCTION key.

I doubt the "one-upmanship" trend of cramming more and more digital features into walkies is going to go away, but they can be made easier to use. A rig this versatile could use a better display system.

The next logical step is a dot-matrix, scrollable menu display like those found on pocket computers. That, along with a better-organized control sequence, would go a long way toward making a nifty radio like this one a joy to operate. At the very least, a "set" mode, in which all the rarely-changed default settings are grouped, would be useful.

Conclusion

All in all, this is the slickest dual-bander I have yet used. It feels good, works well, and has more features than I will ever need. This is a premium rig for those desiring the utmost in versatility. If you're in the market for a dual-bander, check it out. With an improved user interface, it could be close to ideal for everybody.

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Sacred Heart Amateur Radio Club

In April 1991, I had the pleasure of meeting in person with Dave Novak NØDN at the Dayton Hamvention. He and his students had checked into the CQ All Schools Net several times, and we had exchanged interesting tapes, pictures, and letters between our two groups. Our meeting at the Hamvention convinced me that the work of Dave and his amateur radio club students could serve as a wonderful inspiration to other instructors. The following is Dave's write-up about how he organized this exciting program for young people.

De Dave Novak NØDN

I have been licensed since I was in 7th grade. My primary mentor was my dad, Joe Novak WØPGI. As a teacher and youth minister, I began working with junior high students about 14 years ago. My work with them in technical areas began when I was at a school that had a variety show for students, parents, and friends. I began training students in taking still photos, taping videos, and operating sound and lighting equipment. At the next school, I formed a club called the "Media Club," which got the youth involved in computers as well as photography.

Being a "teenage" (ordained 13 years ago!) diocesan priest, I get moved around every few years by the bishop, and I've formed clubs at each school. However, I never did try to interest kids in amateur radio. I believed up until recently that it would be too hard for junior high kids to learn Morse code, and that it would be too expensive a hobby for the general public. I thought to myself: "It is different if a parent is a ham and one of the children get interested, but 'normal' parents just wouldn't understand!"

To be quite honest, my own interest in the hobby had begun to wane. Although at every new assignment I did manage to get antennas up, I often went for weeks without getting on the air. Months would go by without my going to any ham club meetings or hamfests.

With the Help of an Earthquake

Then while at the rectory on the night of the big earthquake in the Bay area, my phone began to ring. Three people called and asked if I could find out about their loved ones. To my surprise, after only a couple of hours on the air I was able to find out that all three parties were alive and well. Perhaps for the first time in my long amateur career (30 years this fall!), I began to realize what a vital service our hobby can provide. I think that night was a turning point for me. Shortly after that, I began getting on the air more frequently and going to ham club meetings, breakfasts, and hamfests.

Soon after that, I was moved to my present QTH. Since it was in the middle of winter, I only put up a temporary antenna. Then in the spring, I put up the tower.

While the maintenance man, Ed Gilmore, helped me level the newly poured cement for the tower, some students passed by and wanted to put their initials in the wet cement. I encouraged them! Over 100 kids wrote their initials, a couple made hand prints, and one girl made an impression of her foot.

The next week I set up a station in one of the classrooms, and arranged for each class (grades 5 through 8) to come in for a demonstration. I printed up a flyer with photos of myself as a young ham. The flyer stated that there would be a "ham radio camp" during the summer. No 8th graders signed up. No 7th graders signed up. No 6th graders, either! Only one 5th grade boy and two 5th grade girls expressed an interest.

At first I was quite disappointed. But I thought: "I didn't get my license till I was in the 7th grade, even with my dad being a ham. How can these 5th graders possibly get their licenses? What the heck—I'll give it a try!"

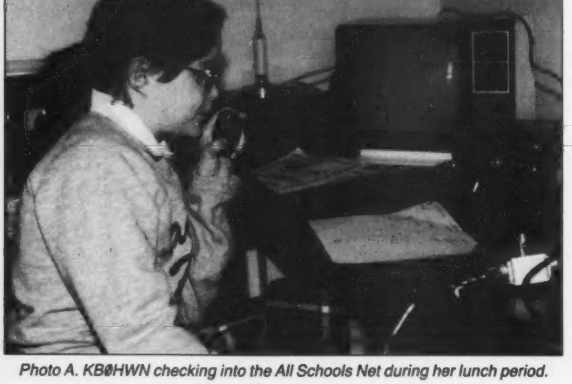

Photo A. KBØHWN checking into the All Schools Net during her lunch period.

Photo B. (Left to right:) Jenny Ebert KBØIYT, Vanessa Gomez KBØIXY, Amy Rosa KBØIRI, Angie Fischer KBØHXY, Dave Novak NØDN, and Mary Ellen Federhofer KBØHWN.

I began by getting them *Tune in the World* kits, and encouraged them to listen to the code tapes. When the camp actually began in July, two more boys showed up. I solicited the help of a ham friend of mine who was free during the day, and also the help of two teenage hams. We met Monday, Wednesday, and Friday from 9 a.m. till noon for two weeks. During this time we studied rules and theory, practiced code, and built code oscillators. Also, one morning we took a "field trip" to visit another local ham. By the end of camp, 4 out of 5 students passed the written test, but none were able to copy the 5 wpm code.

More Students Join the Club

In September, to my surprise, the kids wanted to meet weekly, and some of their friends wanted to join. This presented a challenge, since the original group was so close to getting their Novice while the rest had only good intentions! Then I discovered a retired telephone company engineer, Steve Gies WØKOC, and was able at times to break the group up into two. Also, I found the young almost-hams willing to help their friends out.

Because 5 wpm seems so difficult for someone just learning code, we worked out a special incentive program. There were special prizes for just being able to recognize the alphabet, for receiving at 3 wpm, and for receiving at 4 wpm. Since many of the prizes had something to do with the local ice cream parlor down the street, it became a regular routine of our Wednesday after-school gatherings.

In October, we received a 10 meter transceiver from Uniden, which we set up in the classroom but also allowed kids to borrow and take home after school. I kept the microphone at school so there would not be any temptations too great to resist!

By Christmas, each of the five original members received their Novice licenses: Mary Ellen Federhofer KBØHWN, Angie Fischer KBØHXY, Tom Winkler KBØIBA, Matt Kirchhoff KBØICV, and Patrick Scheu KBØIDH. In fact, Angie received her license on Christmas Eve, and came to church service about an hour early so she could make her first contact. The next day, she had an antenna up in her own back yard. Mary Ellen had received her license just a week or so before, and was also on the air with borrowed equipment.

My original idea was to rely mainly on the school station for the kids to operate. But once I saw the thrill of the kids having a station set up in their own home, I began to look for ways to acquire additional equipment.

Although I knew that we could raise money quickly by selling chocolate bars, I wanted to do something that would bring the group together, and allow the children to use their talents and creativity. The idea of a "dinner theater" came to mind. I knew that some of the girls had already written a skit about dating. I suggested that they write their own rap about ham radio and call themselves "The Code Girls." To my surprise they accomplished this in a few days.

There were some difficult afternoons shortly before the big night when things did not go well! It was only a week away, and some of the kids did not yet remember all of their lines. But somehow when the big day came, the kids did great and everyone had a great time. One of the mothers, Shellie Kirchhoff, was able to fix pasta and salad for over 150 people for only $140! Even though we charged only $5 per person, we ended up making over $700, which included donations from folks who could not come, but sent in $5 or $10 to help out the kids.

Most of the money I had already spent, having just come back from Florida with a station wagon full of radio gear that I had bargained for in Memphis and Indiana as well as Florida. We have about five used radios we have purchased—the best being a Drake TR-3 which we paid only $150 for, and which performed well just as we received it. Some of the other gear that's not working is being restored by Cathy Barne's dad, Wayne Barnes, who repaired radios when he was in the Service.

More Accomplishments

Since the dinner theater, several others have passed their Novice exams: Julie Thien KBØIRH, Amy Rosa KBØIRI, Sean Sitek, Vanessa Gomez,

Photo C. Patrick Scheu KBØIDH (left) and Tom Winkler KBØIBA (right) on low band "ground wave" operation.

Jenny Petersmeyer, and Jenny Ebert. I feel confident that three other members will soon pass their Novice exams: Mark Moore, Cathy Barnes, and Jason Roskowski. The same day Sammy AAØCR received the Westlink Young Ham of the Year Award, we had our first upgrade: Angie Fischer, who passed the Technician exam.

Yesterday I fixed lunch for some of my adult local ham friends, and also arranged for some of our new school hams to join us. After dinner, they performed "Morse Code Baby" then introduced a spontaneous routine. Once they perfect this, we'll make a video of it! (Watch out, East Coast and West Coast! The Code Girls will soon be taking over the U.S.A. by storm and invading everywhere! No classroom within the continental U.S. and maybe beyond will be safe any more entrenched in a pre-technical subculture deprived of their right to the exciting new world of ham radio!)

This week, we are working on plans for a new "Summer Ham Camp" especially for junior high kids. I am meeting with Sammy AAØCR, who has volunteered to help. Most likely we are going to try to acquire a central location where young hams from all over the metro area will be able to participate. We have a lot of work ahead of us, but with almost unlimited enthusiasm and spirit to drive us on!

Please send write-ups on interesting classes, recruiting ideas, youth club activities, or individual children's experiences along with photos, to Carole Perry at the above address.

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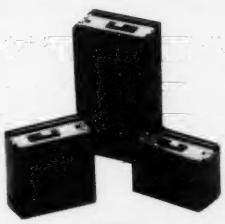

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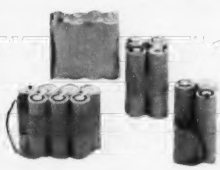

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CIRCLE 191 ON READER SERVICE CARD

73 Review *by Bill Clarke WA4BLC*

The Drake R8 Receiver

Tune in the world with this hot new receiver.

R.L. Drake Company
540 Richard Street
Miamisburg OH 45342
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Tel. (513) 866–2421.

A Drake, a real Drake! The folks from Miamisburg have finally produced a new product for the radio hobby market—a high grade communications receiver aimed at the lucrative and popular SWL market.

Before I started this review I looked back into radio history and found that from about 1979, the Drake R7 communications receiver was the last available Drake HF receiver. The last piece of HF ham equipment from Miamisburg was the TR7 from 1978, from which the R7 got its general appearance and features.

Prior to the R7, Drake communications receivers included the DSR1 (1971) and the DSR2 (1974). One of their most popular receivers was the SPR-4 from the early 1970s. All solid state and featuring a linear PTO and vernier dial providing 1 kHz readout. So much for history; let's look at this new release from Drake.

Appearance

The R8 has a very functional, business-like look, sporting few manual controls, and a black finish. The lack of radio-like appearance is due to the heavy reliance on state-of-the-art digital control. There are only six standard analog controls on the unit, as nearly every possible selection that can be made by switching is accomplished via the dual-purpose keypad or a function switch.

First Impressions

The most apparent feature of the R8 is the very complete LCD display. Measuring 5.5" x 1.5", it displays all functions and settings in bright characters on a black background, making status checking super easy.

The layout of the function buttons places them directly beneath their corresponding readout points, making selections of AGC, bandwidth, mode, etc., very easy to use as well.

Frequency control is via direct entry on the keypad, with the UP/DOWN buttons (in 100 kHz steps), or a TUNING knob (with a choice of tuning speeds). The frequency reads out to 10 Hz (user selection). When put on a frequency, the rig can be locked and it will remain there indefinitely. It's very stable. There are two VFOs which you can select instantly via function switch, and 100 nonvolatile memories. This means no batteries are required for memory backup; power interruptions will not erase the memory.

Scan features allow scanning of all memories, selected memories, or the frequencies between the settings of VFO-A and VFO-B. The SQUELCH control greatly enhances the use of SCAN, and is active in all modes.

Bandwidth from 6 kHz to 500 Hz can be selected in all modes. This is a very good feature for crowded band conditions, and for fidelity during better times. After all, AM does sound better at 6 kHz wide than at 1.8 kHz. But each bandwidth has its place and use.

Photo A. R.L. Drake's new R8 receiver for SWLing.

Photo B. The R8 can be connected to various antennas as well as to a computer through the RS-232 port.

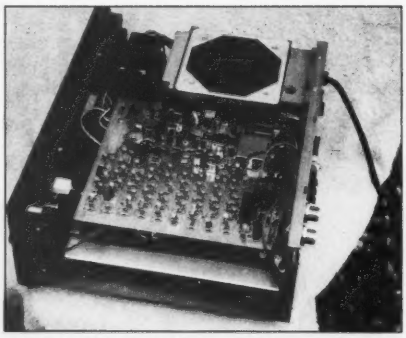

Photo C. This inside view of the R8 reveals just how neat and sturdy it is!

The controllable AGC, NOTCH FILTER (manually operated from an analog control), NOISE BLANKER, and RF input controls (analog and switched attenuator/preamp) all combine to make the receiver very flexible.

Unlike ham equipment, the R8 has a built-in clock/timer with an output port on the rear for remote control of a tape recorder (or other hardware). This time feature is very popular with SWLs for recording odd-hour programs, and it can also be used in a clock-alarm-radio scheme (though a very expensive clock-radio). The clock also displays time on the LCD when the unit is powered off.

The fold-down front feet make table placement and viewing of the LCD display and S-meter clear and easy.

In many ways, the R8's control and display system is not far from that of a modern, full-featured 2 meter HT. Loads of bells and whistles provide extensive flexibility.

The manual that comes with the R8 is very well done, with complete explanations about each feature and control. A section is included that delves well into computer command of the digital switching system, and a log is included to write down the pertinent information about what is entered in each of those one hundred memories. It is, however, without block and schematic diagrams.

Operating the R8

The R8 was tested on a 160 meter Carolina Windom antenna (about 265 feet long) at 50 feet, and also on a 40/75 meter dipole at 35 feet. It was compared, via an A/B switch system, with an ICOM R71A. I selected the R71A due to its excellent reputation as a "world SWL standard."

The tunability and stability of the R8 are excellent; however, although the tuning knob has a good weight, it's a little small for my taste.

I am a real believer in keypad frequency entry. It is quick and accurate. The rubberized keypad is easy and flawless to operate.

When in the AM mode, I found the SYNCHRO (synchronous detector) to be great when fade-caused distortion became a problem. This is a feature that really works.

Specifications	
Frequency Range	0.1–30 MHz
Modes	AM, LSB, USB, CW, RTTY, FM
Sensitivity	SSB & CW (10 dB S+N/N) <1 µV (0.1–1.5 MHz) <0.5 µV (1.5–30 MHz) <0.25 µV (5.0–30 MHz) preamp on AM (10 dB S+N/N) <3 µV (0.1–1.5 MHz) <1.5 µV (1.5–30 MHz) <.8 µV (5.0–30 MHz) preamp on FM (12 dB SINAD) <.5 µV (1.5–30 MHz)
Frequency Stability	<±10 ppm (-10°–50°C)
Frequency Accuracy	<±100 Hz (-10°–50 °C)
Selectivity	AM, LSB, USB, RTTY, CW 6 kHz @ -6 dB–<12 kHz @ -60 dB 4 kHz @ -6 dB–<8 kHz @ -60 dB 2.3 kHz @ -6 dB–<4.5 kHz @ -60 dB 1.8 kHz @ -6 dB–<3.6 kHz @ -60 dB 500 Hz @ -6 dB - 1.5 kHz @ -60 dB FM 12 kHz @ -6 dB - <25 kHz @ -60 dB
Ultimate Selectivity	>95 dB
Image Rejection	>60 dB (100 kHz–1.5 MHz >80 dB (1.5–30 MHz)
IF Rejection	>80 dB (45 MHz) >100 dB (50 kHz)
Dynamic Range	>90 dB (1.5 - 30 MHz @ 20 kHz spacing)
3rd Order Intercept Point	>+5 dBm @ 20 kHz spacing >-20 dBm @ 5 kHz spacing
IFs	First 45 MHz; Second 50 kHz
AGC	Attack time 1 ms Release 2 sec (SLOW)–300 ms (FAST)
Antenna Input	50/500 ohms
Notch Filter	Audio Type >40 dB depth (500–5000 Hz)
Audio Output	2.5W @4 ohms with <10% distortion
Recorder Output	300 mV @4.7k ohms
Demod Output	300 mV @ 4.7k ohms
Clock Accuracy	<±2 sec/month
Power Requirements	100/120/200/240 VAC (60 Hz) @40W 11–16 VDC @2 amps
Size	13.1"W x 5.2"D x 13"D
Weight	13 lbs.
Accessories	•VHF converter 35–55 and 108–174 MHz •Matching external speaker •Software package for the IBM XT/AT (clones) to allow enhanced operation of the R8

The NOTCH filter, although effective, was disappointing in depth and in its analog operation. I cannot understand why any manufacturers produce receivers with manually operated notch controls today. My Datong ANF (Automatic Notch Control) knocked out tones the R8 could not—and with no manual control input!

The PASSBAND OFFSET was, as expected, effective in removing interference from nearby signals. Selecting a narrow bandwidth made it all the more effective.

I was not impressed by the internal speaker with its typically poor fidelity. An external speaker is a must for real enjoyment.

The S-meter read as expected, and compared in accuracy to other receivers.

The tone control lacks real BASS/TREBLE authority.

The R8 is a natural for computer control, since all controls, except for those in analog form, can be commanded via the RS-232 port. Command information about computer interfacing is given in the manual (this section is very good). Suggested software for computer control includes PROCOMM PLUS™ and BITCOMM™ operated on an IBM XT/AT or clone. Optional software is available from Drake for use with the R8 (not available for this evaluation).

On a warm summer evening when the popcorn (static caused by distant thunderstorms) was popping heavily, I listened to my regular nets with the R8. The R8 held its own very well, being less affected by the static than my ICOM IC-751A transceiver. It was not as quiet as the Ten-Tec Corsair II, but then, these pieces of equipment are of a very different design and purpose.

The choice of bandwidth made it fairly easy to reduce nearby signals, such as those that abound on 75 and 40 meters. Add the passband filtering, and you can just about eliminate any adjacent signals as much as is possible.

Speaking of bandwidth, you should hear what a real strong LSB signal on 75 sounds like through the 6 kHz filter. Just like broadcast AM! Too bad I couldn't locate the mike plug on the R8.

A Few Comments

After carefully evaluating the Drake R8 receiver, I must say that I am well pleased with its performance. Over the years more than a few pieces of Drake equipment have passed through my shack, and I still think you have to go a very long way to beat the receivers of the R4 series. They were quiet, stable, selective, and sensitive. The R8 compares favorably with these older receivers, as few digital-type receivers can.

Modern digitally-controlled receivers make lots of internally manufactured noise—noise that adversely affects their operation. The Drake R8 does not suffer appreciably from this problem.

The R8 is like a breath of fresh air, with its ground-up engineering and up-to-date digital control from the front panel. I am very pleased to see a quality HF receiver of American manufacture that should successfully compete on the world market.

Oh yes, a public question for Drake: Where is the T8 transmitter to go with the R8? The world is waiting!

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MRF137	24.00	SD1278-1	15.75	2SC2642	28.25
MRF138	35.00	SD1407	29.90	2SC2694	46.75
MRF150	68.75	SD1428	34.00	2SC2695	31.75
MRF171	34.50	SD1429-3	37.70	2SC2782	37.75
MRF172	60.00	SRF2072	13.75	2SC2783	59.85
MRF174	80.00	SRF3662	28.50	2SC2879	21.90
MRF207	4.75	SRF3775	14.75	2SC2879 MP	49.50
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Build the TBOX

At last, you won your club's competitive RDF contest ("foxhunt" or "T-hunt"). Now it's your turn to hide the transmitter. You've driven for hours to pick the perfect hard-to-find spot, but now you need some distinctive audio to transmit, and a way to ID the hidden "T."

You could stay with your rig and talk throughout the hunt. But that's hard on your throat and gets boring after a while. Besides, if hunters spot you, they'll know where the "T" is. It's lots more fun to conceal the fox, perhaps even bury it! Then you can stay under cover nearby and watch the fun as the hunters approach and try to "sniff" it out.

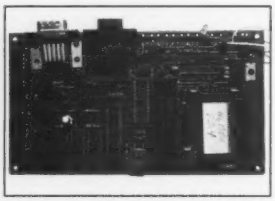

Photo A. Prototype TBOX circuit on N6MBR's PC board.

What you need is a "tone box" or "foxbox." A good one produces a distinctive sound, so the hunters have no doubt that they're tracking down the right signal. It cycles the transmitter on and off periodically for intermittent-signal hunts.

A foxbox must incorporate station identification, to comply with FCC rules. The callsign should be easily changeable, to accommodate upgrades and permit the box to be used by all members of a hunting group. Small size and low battery drain are important design objectives.

Micro-P Solution

Several good discrete-logic circuits for tone boxes have circulated among T-hunters over the years. But for the utmost versatility, a microprocessor is ideal.

Ron Seese N6MBR is an active T-hunter with the Conejo Valley Amateur Radio Club, based in Thousand Oaks, California. He is also a clever digital designer and has developed a multi-featured foxbox designed around the 80C31 CMOS microprocessor. He calls it TBOX—a box to control the hidden T. It meets all the above requirements, yet it contains only six ICs and a few discrete components.

TBOX provides a readily-identifiable tone pattern for the hidden transmitter audio. Or, if you prefer, it sends randomly-pitched beeps. Transmission can be continuous, with regular CW identification.

For intermittent-signal hunts, it automatically turns the transmitter on and off at regular intervals, with CW ID on each transmission. You can select on and off times over a wide range. To save your batteries, TBOX draws only 60 mA at 12 VDC.

TBOX programming does not require a myriad of switch settings. In fact, there is only one switch on the unit—the power switch! To set the TBOX parameters (such as mode, callsign, CW speed, and on/off timing), just hook the RS-232 cable to your computer, load your modem program, and use TBOX's programmed-in menu structure. It's much like setting the parameters on your packet TNC.

A battery-operated computer with RS-232 port is perfect for programming your TBOX. If you don't have one, it doesn't matter. You can program it with your home computer (my old Kaypro works just fine) or even a dumb terminal.

TBOX includes a non-volatile memory (EEPROM) that remembers your hunt parameters. After programming, disconnect TBOX and take it to the hiding spot. When you turn it on in the field, it will come up just as you programmed it.

How It Works

Figure 1 is the complete TBOX schematic diagram. CPU chip U1 executes the program of EPROM U3. U1 contains 128 bytes of dynamic RAM built in. R6 and C1 reset U1 at power turn-on to ensure proper startup. EEPROM U5 holds the callsign and other configuration data during power interruptions. RS-232 interface chip U6 links the unit to your computer via J1 for parameter setting.

J2 connects TBOX to your hidden transmitter. Q1 and associated components close the radio's push-to-talk (PTT) circuit. C8, C9, C18, R9, and R10 buffer the transmit audio. Potentiometer VR1 sets proper modulation level.

R11 combines the PTT and audio lines to drive hand-held rigs. For ICOM HTs, use a 3.9k resistor at R11, and hook only the AUDIO output line to the HT's mike input. The same connection works for Yaesu HTs, except that R11 is 2.2k. For non-hand-held transmitters, delete R11 and connect the separate PTT and AUDIO OUT lines to the appropriate pins on a mike plug to mate with your rig.

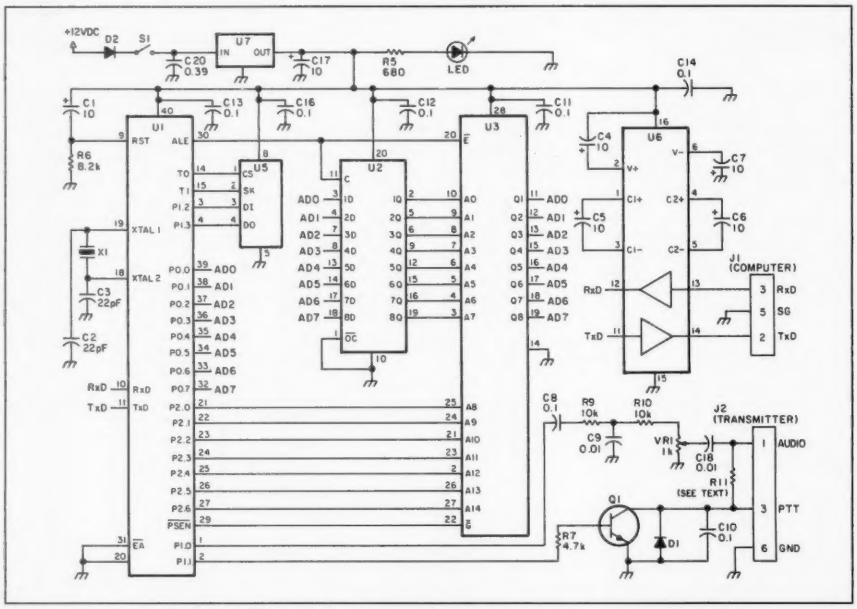

Figure 1. TBOX schematic diagram. All capacitances are in microfarads, except C2 and C3.

Let's Build It

If you enjoy wire-wrap assembly, you will have no trouble duplicating Ron's circuit from Figure 1. Be sure to put capacitors C11–C14 and C16 as close as possible to the appropriate ICs to prevent unwanted oscillation and interaction. I suggest socketing all ICs except the +5V regulator. Be sure to use a socket at U3 to permit program upgrading.

If you have access to a "PROM burner," you can program U3 yourself. The latest BIOS program (version 0.7 as of this writing) is available on the 73 BBS at (603) 525-4438. Hams on the West Coast can find it on the NOMAD PCBoard BBS at (805) 498-3500. File names are TBOX07.BIN and TBOX07.DOC.

If you're like me, you would prefer a PC board, and would rather have someone else do the work of making the board and programming the BIOS PROM. Fortunately, N6MBR has done it. Send Ron a check for 35 dollars and ask for the "Homing In" TBOX package. He will mail you a blank 3.25" x 6" double-sided circuit board (see Photo A) and a programmed PROM. He will also throw in one of the hard-to-find EEPROMs for U5.

Of course neither I nor *73 Amateur Radio Today* can warrant this offer. But I can assure you that the six boards used at this spring's Friendship Radio Games foxhunt worked flawlessly. The board is high quality, with plated-through holes. Parts layout details are included.

The ICs in N6MBR's board are so close together that some sockets may not fit. I used pin-line socket strips instead. These are solder-tail socket contacts that come in rows of 25 to 40. Just break off as many as you need for each row of each DIP and solder them onto the board. They are small enough to allow ICs to be side by side only 0.1 inch apart.

Note on the schematic that certain part designators, such as U4, are not used. Also, there are holes and etch for

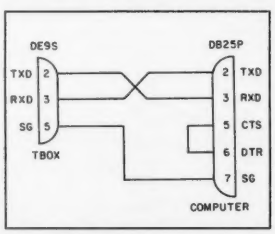

Figure 2. Typical cable connections for computers/terminals with DB-25 RS-232 ports.

Parts List

U1	80C31	CPU
U2	74HCT373	latch
U3	27C256	EPROM
U5	93C46	EEPROM
U6	MAX232	RS-232 interface
U7	7805CTH	voltage regulator
Q1	2N2222A	transistor
D1	1N914	diode
D2	1N4001	diode
X1	12.0 MHz	crystal
J1	DB9PRA	male connector
J2	DB9SRA	female connector

Sources of Parts: ICs, connectors, crystal: JDR Micro Devices, 2233 Branham Lane, San Jose CA 95124. Tel. (800) 538-5000. PC board, PROM, EEPROM: Ron Seese N6MBR, 6136 Landino Dr., Westlake Village CA 91362.

additional parts on the printed circuit board. Those parts are not needed for this version of TBOX. Ron is working on new features that use them. I'll have more on that next month.

Capacitor C20 is essential to prevent U7 oscillation when supply leads are long. There are no holes for C20 on the PC board, so "airline" the part on the back of the board.

Firing It Up

Carefully inspect your work after assembly. Pay special attention to polarity of the electrolytic capacitors, particularly those on U6. Check for shorts on the +5V line before installing the ICs.

Install U7 first, then power up the unit and check the +5V bus. If everything is OK, remove power and install the remaining ICs. Now hook up the computer and transmitter interfaces.

Figure 2 shows wiring of a typical cable to connect TBOX to a standard DB-25 RS-232 port. TBOX is configured as Data Terminal Equipment (DTE). This means that TXD on TBOX goes to RXD on the computer, and RXD on TBOX goes to TXD at the computer.

Your computer or terminal program may require a high signal on the DCD line (pin 8 of DB-25). If so, add a jumper from pin 6 to pin 8.

Software and hardware handshaking is not used. Flow control in your terminal program is not necessary, so turn it off. Set the computer to 2400 bps, 8 data bits, and no parity.

Put a dummy load on the transmitter and listen to the TBOX signal on a separate receiver. At power up, TBOX outputs the menu to the computer, then goes into transmit mode. Press the return key on the terminal to stop transmitting, and enter the command mode. When setting parameters, simply enter three digits. For example, to set Mode 2, type "M" and then type "002" without a carriage return.

Your turn to hide the fox may come sooner than you expect, so get started on your TBOX now. Next month, I'll have more on programming and using your tone box. 73

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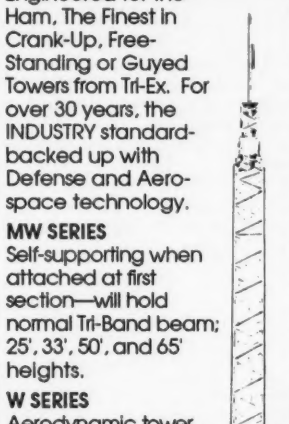

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Have a BLT for Launch

After watching videos and demonstrations of other balloon experiments, members of the Houston AMSAT group decided to put together their own launch effort. Dubbed the BLT (for Balloon Launch Team), they decided to build an inexpensive 2m FM telemetry package for their first flight.

This first package (BLT-1) carried a 100 mW 2m FM transmitter (see the August 1990 issue of *73*) which sent out an audio telemetry sequence. A custom designed analog telemetry system sent out a series of tones seperated with a CW message. The pitch of the tones determined pressure, and inside and outside temperature. The altitude was determined with a pressure sensor circuit designed by John Fleischer of the Transolve Corporation (the circuit appeared in the October 1990 issue of *Radio-Electronics*). The original design was meant to be used up to 20,000 feet on model rockets, but the BLT group used just the analog portion and recalibrated it to operate up to over 100,000 feet. Since the package didn't generate a lot of heat, Andy WA5ZIB included a chemical heat pack to keep things warm during the flight.

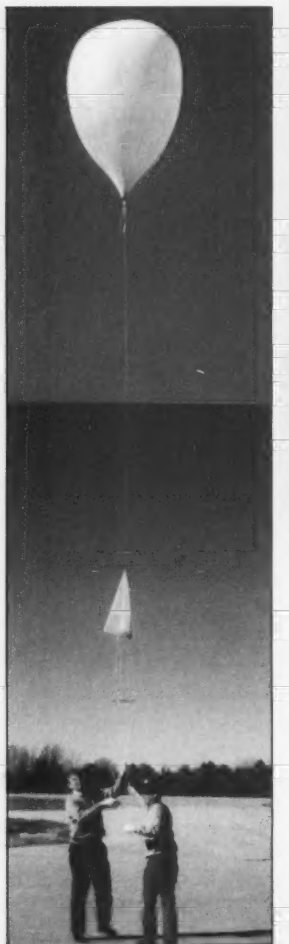

Photo A. Burns Cleland WB5HLZ (left) and Allan Fox N5LKJ (right) prepare to launch a BLT special to the edge of space.

Photo B. Andy MacAllister WA5ZIB puts the finishing touches on the first BLT experiment.

On December 8, 1990 the BLT group sent their first payload up from the Huntsville Texas Municipal Airport. After a great flight up to over 100,000 feet, the package parachuted down to land about 30 miles to the south near the town of Magnolia. Reception of the telemetry signal was observed over a wide area of Texas and Louisiana.

Recovery Texas Style

After a long search, the chase crew eventually pinned down the landing site about a mile or two off of the main highway. Things were going well until they asked the ranch owner if they could search for their package. He replied, "NO, come back tomorrow!" Nothing more frustrating than hearing your payload crying out for help and not being able to do anything about it.

The dejected tracking crew almost decided to risk their lives and go in anyways but thought better of it. A couple of trackers returned the next day and to their amazement the payload was still transmitting! The landowner took them back through several locked gates as they closed in on the package. It turned out the payload had parachuted down in the middle of a large private (and heavily patrolled) hunting preserve! After a short search they found the payload hanging about 80 feet up in a tree.

One of their escorts disappeared for a few minutes and returned with his rifle. With just a few shots, he cut the string (90 feet away) and brought the payload tumbling down out of the tree. Everyone was thankful they had the foresight not to trespass the night before!

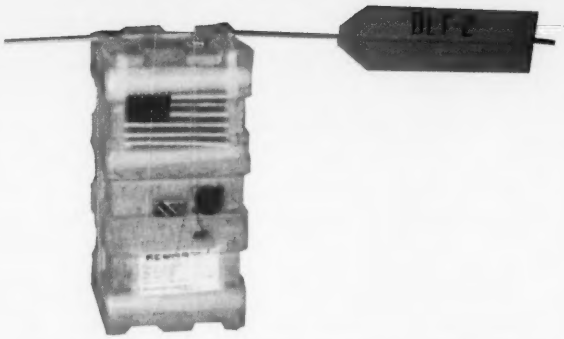

Photo C. The second (and third) BLT payload. The weathervane helped maintain stability during the flight. Note the Radio Shack beeper which helped the chase team to hear the downed payload. The TV camera/mirror is on the other side of the payload.

BLT-2

With the success of their first flight, the South Texas Balloon Launch Team embarked on a much more ambitious effort. This payload contained an ATV transmitter with a live TV camera (GBC CCD-100), active mirror control (to point periodically at the horizon or the ground), digital voice ID on the video subcarrier (the messages changed with various stages of the flight—one of them actually said, "I'm falling" during the parachute descent), a CW HF

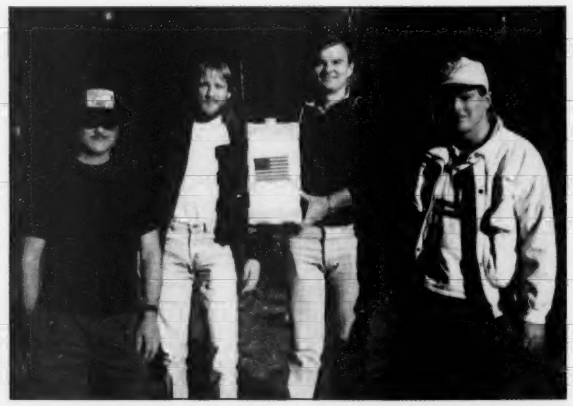

Photo D. The chase team recovers the first BLT payload nearly 30 hours after launch. . . and it's still ticking! L to R: Mike WA5TWT, Mike N5QMG, Burns WB5HLZ, and James N5PRQ.

The Balloon Launch Team of South Texas

High Coordinator	WB5HLZ
Payload Master	WA5ZIB
Payload Integrator	WA5TWT
Captain Video	N5JXO
Computer Wizard	WB5TTS
Earth Software	N5LCO
Analog telemetry	WA5ZIB
Antennas	N5EM
ATV system	N5JXO
Back-up power	N5SUA
Balloon system	WB5HLZ
Camera system	WA5LHM
DF leader	KC5CP
Digital voice	N5JXO
Flight computer	WB5TTS
Flight plan	WB5HLZ & WB8ELK
Flight software	WB5TTS
Mirror system	N5RPQ
Net control	WB5HJV
Power system	WB5HLZ
Telemetry software	N5JCO
Thermal control	WA5TWT
Tracking software	WB8ELK
VHF transmitter	WA5ZIB
Video ID/sequencer	WB8ELK
10m beacon	K7IRK
Weatherman	KA3BKU

The Whole BLT Crew: WD5BDX, WB5BGQ, KA3BKU, KC5CP, WD5DZC, WB8ELK, N5EM, WB5HJV, WB5HLZ, N5JXO, WD5JRD, N5LCO, WA5LHM, N5LKJ, N5MPN, WA5PCD, N5QMG, N5RPQ, N5SUA, WB5TTS, WA5TWT, WB5UUK, WA5WOD, WA5ZIB, A. Alexy, J. Edinburgh, J. Johnson, J. McKelvy, J. Mock, S. Ross, C. Summerville, Civil Air Patrol, Brazos Valley ARC and Electronic Parts Outlet.

beacon on 10m, and 2m FM telemetry that even included a packet telemetry downlink from the onboard flight computer.

The flight computer took the analog telemetry signals and converted them to ASCII text for the packet and CW downlink. It also controlled the TV camera mirror. During ascent, the computer would cycle the mirror to point at the ground or the horizon every 50 seconds. During the parachute ride back to earth, the mirror stayed in the down position to look for distinguishing landmarks on the ground.

Crash!

BLT-2 was launched from the Wharton Texas Municipal airport on the morning of May 11, 1991. Due to 10 mph winds, the balloon crashed into the side of a hangar just seconds after liftoff! The 10m CW beacon transmitter (a 28.322 MHz Fireball transmitter built by Bob Moody K7IRK—see the November 1990 issue of *73*) was ripped off the package along with the ATV antenna. The flight computer reset to a dormant mode and the stabilization fin fluttered back to the ground. The balloon and what was left of BLT-2 headed skyward (fortunately the 2m beacon still worked). Spirits were definitely not as high as the balloon at this point. Fortunately the balloon burst prematurely at 27,000 feet (probably due to the crash). The direction-finding crew went into action and quickly found the package 12 miles away in a field near Egypt (Texas). It was noon, so the crew dusted off the payload, reset the computer, glued the ATV antenna back on, and re-attached the 10m beacon. It was time to try again.

Two Flights in One Day

The hastily refurbished BLT-3 was ready to fly. This time the launch team carefully choreographed the release sequence which resulted in a beautiful takeoff (no crashes this time).

Fantastic live camera images from the payload delighted everyone watching the ATV receiver at the launch site. Telemetry from the packet downlink was displayed on laptop computers at mission control as well as by the chase crew. Those without packet stations had a blast decoding the CW telemetry. The ATV signal was received as far away as Dallas (over 250 miles) and the 2m FM telemetry could be heard on HTs at that distance as well. The 50 milliwatt 10 Fireball beacon was even heard 500 miles away (groundwave) by Warren W5DFU in Tulsa, Oklahoma.

This time the balloon landed 18 miles to the north in a hayfield near Wallis. The now-experienced chase team found the payload in short order. A lot of fun and adventure was had by all. Look for future flights from the South Texas BLT. 73

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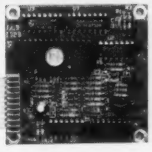

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Notes from FN42

Lots of news this month, and promises of more to come: Zafizis Tzobakas SV2AHT will report on the mountain climbers of Greece, who made another trip to the high country with an expedition to Pamir of the Himalayas last July. Jonas Paskauskas LY2ZZ will provide us with the results of the Ham Conference that took place in June. And we have another volunteer Hambassador, Ed Sershon DL/N7PHY. He and his wife have moved to Germany from Seattle, Washington, USA and expect to be there for many years. If you have information for him, send it to Ed Sershon, Ferdinand Thomas Weg 6, 3389 Braunlage, Germany.

Skip Westrich WB8OWM wrote us a nice letter to let us know how much he enjoyed the article about "Box 88 Moscow." He also wrote to Ron Gang 4X1MK, who had submitted the article compiled by Oded 4X4SO. Thank you, Skip. We appreciate feedback from our readers. Those of you who have special wishes as to what you would like to see in this column from other parts of the world, please write! I can put the request in the column.

73 receives many beautiful QSL cards each month. Since only one can be chosen for "QSL of the Month," Associate Editor Joyce Sawtelle slips me the best of the rest, to see if I can use them in my column. Even though these cards do not win the free one-year subscription, at least they are published for all to enjoy.

The one I really enjoyed this month was submitted by Gonzalo De Murga CX6RN for his radio club, CX1RA. The DX team from his club uses the call sign CV1R. The lighthouse on the card was built in 1876. Note the sea lions on the rocks. The lighthouse on the Isla de Lobos ("Island of Wolves") would make a dandy radio tower, don't you think?—Arnie, N1BAC

Roundup

Czechoslovakia From a letter from Jiri Pecek OK2QX, translated by OK2YN, on "Czechoslovak Radio Amateurs and the Council of Europe DX-pedition TP5OK."

The Council of Europe (C.E.) in Strasbourg, France has 42 years of history, founded in 1949. The group of active radio amateurs associated with this organization initiated the Council of Europe Radio Amateur Club (CERAC), similar to the radio clubs at the United Nations and the International Telecommunications Union. The president of CERAC is Mr. W. Rossle, who is also the director of the audio visual service of the C.E. The primary force behind the ham activity is Mr. Francis Kremer, F6FQK, the appointed director of the special event station with the permanent callsign of TP2CE.

The station is situated in an extraterritorial area in the main building of the C.E. Even though it should have the same rights and status as 4U1ITU, it has not been recognized as a separate country yet by the DXCC Committee.

There have been eight short DXpeditions to TP2CE in the past. It has been proposed to activate this callsign on the occasions of admitting new members to the C.E. For example, when Hungary was admitted last November. At that time it used the callsign of TP5HA.

Photo A. QSL card for CV1R and CX1RA (other side) of Maldonado, Uruguay, South America.

I was given the opportunity to take part in activation of this station at the end of 1990. After exchanging some letters with our Federal Ministry of Foreign Affairs, CERAC and the representatives of the F.I.S.A.I.C. in Czechoslovakia organized the DXpedition as the event of the Association of the Czechoslovak Radio Amateurs Railroaders, as I am also president of the newly formed branch of the F.I.S.A.I.C. Thanks to the kind support of the headquarters of our State Railroads and of the F.I.S.A.I.C., the railroad transportation was at no cost.

I arrived in Strasbourg on Friday afternoon, April 26, at the railway station, but in spite of previous arrangements no one was there to meet me. I was in a strange country without knowledge of the language, but the local police gave me directions to the C.E. building.

The operation of the station was teamwork with the aforementioned people, Philippe F6GOC (physician and technician) and Santiago FD1RAY (ex EA4EII, DA4BJ, and TJ1/EA4EII), the permanent ambassador of Spain in the C.E.

At first the equipment used was a Kenwood TS-440 and SB-200 amp, but Philippe brought an ICOM IC-761 and power amp (800 watts out) the following day. The antennas were a 5-element beam for 20/15/10, a dipole for 40 meters, and a 3-element fixed beam for 80 meters. My operation was on SSB only, but the next DXpedition will be CW only.

We logged on a laptop computer which was really nice, except that the French keyboard was not the classic QWERTY keying which caused me to have to search for each key individually. To increase the speed of operation we helped one another by one operating and the other logging. This did not work very well when I was operating in the Czech language or beating down the pile-up of U-stations in Russian because the logger did not understand those languages. At those times I had to keep the log myself.

In spite of all the problems, we made 1,718 contacts in about 26 hours. The last contact was made at about 1700 on Sunday, and I was on the Eurocity Express departing at 1807.

The callsign used, TP5OK, will never be heard again, as it was used on the occasion of admitting Czechoslovakia to the C.E. as its 25th member. The next activity of this station should be later this year, probably during the occasion of admitting Poland to the C.E. with the callsign of TP5SP.

This event was good training for future DXpeditions. I am hoping to visit ZA-land in the future and wish to be the first to operate there. I am in contact with the Embassy of Albania in Prague which is attempting to help me. I hope that future DXpeditions will receive the support from the Czechoslovak Radio Amateurs Society.

The CERAC issues two diplomas: the first, the Council of Europe Award, for contacts with the member countries of the Council of Europe; the second, the European World Wide Award (EWWA), for distinguished countries from all the world round. Those interested may apply—the diplomas are worth it! *[OK2QX, Jiri Pecek, Riedlova 12, 750 02 Prerov, Czechoslovakia.]*

Japan From the JARL Newsletter: BAND PLAN: Up to now the JARL has formulated an amateur band plan by listening to the demands of amateur radio operators, but now the Ministry of Posts and Telecommunications has officially issued a band plan.

The purpose of this decision is to give the plan authority according to radio law, and to encourage efficient and orderly use of amateur bands by placing a legal requirement on all amateur radio station licensees, whether they are JARL members or not, to adhere to the band plan.

Silent Key: On May 20, the first woman amateur radio operator in Japan, Mrs. Chiyono Suzuki (nee Sugita), ex J2IX, died at the age of 84. She became the first YL ham on October 14, 1933, in pursuance of the will of her elder brother, Mr. Toshio Sugita J1DN, when he died suddenly. After WWII, Mrs. Suzuki was known to have become very active once again under the callsigns JG1WKS and JJ1SNC.

8J1RL, Antarctic: JARL has received a letter from Mr. Toyoshi Arisawa JA4EDV, a member of the 32nd Japanese Antarctic Research Expedition (JARE) team, who left Tokyo for the Antarctic on November 14, last year. The current state of amateur radio operations is:

1. General state of operations: Almost all QSOs are made on 21 MHZ during lunch break, 12:30–13:00 local time (0930–1000 UTC) Monday through Friday. The total number of stations worked as of May 21 was 560.

2. 8J1RL: A tower about 15 meters high is being used for normal operations. At present we have three projects planned—a new pole intended for Europe, a dipole for 7 MHz, and an antenna for other WARC bands.

3. Miscellaneous: HF packet was operated experimentally from May 6 to May 19. A beacon at 21.1045 succeeded in making contact with JF1SNA in Japan on May 9, 0907 UTC. This was probably the first official packet communication ever effected between Showa Base and mainland Japan.

Latvia A letter from the Kipsala DX Club in Riga: 1. Yuri Baltin YL2DX started another polar trip on July 1 to several new IOTA islands and F.J.L. in the Russian Arctic: 4K2DX, 4K3DX, and 4K4DX. All QSLs only via the manager, Mrs. Aifa Dimde, YLR-48-18, P. Kaste 18, Riga, 226048, Republic of Latvia, Europe. Please SAE with return postage. Do not put on envelopes any callsigns, and wrap all contents reliably.

2. Aifa Dimde will only keep for the next six months the logs and QSLs of the following active stations: EK1KP (Graham Bell Is., F.J.L., Aug. 1990), EK0AC (Komi Rep. & Yamal Reg., ONLY March 1991), RQ2WCY (World Comm. Year, Nov.–Dec. 1983), UA0K/UZ3AXX (Keperweem, Chukotka, July 1990), UK2GAB (1974–1984), UQ1GWX (1985-1990), UQ1GXX (1984–1989), UQ0GZZ (only Jan. 1985), YL2RG (Special Stn., Dec. 1988–Jan. 1989, Oct. 1989), and YL200SM (S. Morse Bicentenary, April 1991).

3. Any ham having at least five QSOs in CW during April 1991 with Memorial S. Morse stations (such as YL200SM, M0RSE, VI91SM, 3A200SM, I200M . . . etc.) can get a splendid special TROPHY from the YLCWG in memory

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4. New QSL routes for YL1XX, YL2DX, and YL25RF: 226001, Riga-1, P.K. 10, Ostrzygallo, Republic of Latvia, Europe. Please mail as above, and without the telltale bulge of a folded SAE.

5. The Soviet QSL Bureau, Box 88 Moscow, does NOT work for Latvian hams (all YL, UQs) any more.

Lithuania *[Article from a Colorado newspaper read during my vacation.—Arnie]* From the Rocky Mountain News, July 14, 1991, by Holger Jensen, News International Editor: Lithuanian ham told world of Soviet invasion. "One of the unsung heroes of Lithuania's drive for independence is Gintas Sakenas, a ham radio operator better known to American hams by his callsign LY2BKW.

"When Soviet Interior Ministry troops, the notorious Black Berets, invaded Vilnius, the capital of Lithuania on Jan. 13, he was the first to inform the outside world.

"For 14 hours, Sakenas was the sole source of uncensored information from his homeland—the Soviets had seized all regular broadcast stations, TV networks, and other news outlets in Lithuania, and had surrounded parliament."

Along with information about the situation, Sakenas also provided a relay from hams in the parliament building. After 14 hours of operation, he received a tip that the Soviets had traced his signal and he had to shut down. Several weeks later he was able to return to the air to reassure hams that he was okay.

Sakenas was in the United States as a treat provided by four American hams: Richard High WØHEP of Aurora, Colorado; Budd Drummond WJ6Q of Redding, California; Wayne Peterson of K6ZSJ of Woodside, California; and Chuck Carpenter N6CFQ of Riverside, California.

"Sakenas is convinced his republic eventually will get its independence. And he concedes he probably won't be able to take any more two-month vacations when it shifts from a state-controlled to a free-market economy." But, Sakenas said, "It will be worth it. We were independent before Stalin annexed Lithuania, so we know how to stand on our own two feet."

Saudi Arabia Media Release from the Ministry of P.T.T., Kingdom of Saudi Arabia: Saudi Arabia will display the Kingdom's up-to-the-minute communications technology in a pavilion of traditional Arabian architecture during the world's most prestigious telecommunications exhibition, Telecom 91, this October 7–15 in Geneva, Switzerland. The theme of the Saudi pavilion will be "The Cradle of Islam Speaks."

The Saudi Minister for Post, Telegraph and Telephone, Dr. Alawi Darweesh Kayal, said Saudi Arabia's display would be a significant part of Telecom 91, the 6th four-yearly world telecommunications exhibition and forum.

The Kingdom's telecommunications web, including 5,000 kilometres of coaxial cable and more than 450 microwave radio towers covering 15,000 kilometres, is considered the Middle East pace-setter, and one of the world's most modern networks. It is among the first to move towards all electronic telephone exchanges. It combines satellite, microwave radio, optical fibre, and submarine cable systems.

Switzerland From the International Telecommunications Union (ITU) Press: With the aim of highlighting worldwide production of quality films and videos, the ITU will host the 6th International Film/Video Festival on Telecommunications and Electronics: GOLDEN ANTENNA 91, in Geneva from 7–15 October 1991. This exhibition has met with increasing success since 1971. It is open to the 164 member countries of the ITU, to exhibitors at TELECOM 91, and to representatives of the telecommunication industry.

As of 10 June the headquarters had received 78 entries from 18 countries and three regional organizations. *[What I find interesting to note is that Japan and the Japan Amateur Radio League, Inc. was the only country and organization to have submitted a ham oriented film/video as of June 10. Their presentation is on JAS-1b/FUJI-2, Amateur Satellite Communications.—Arnie]*

Yugoslavia/Slovenia Packet message passed on by Ron Gang 4X1MK as sent by Iztok YU3FK: *[The packet message was sent to ALL BBSs in Europe on the subject of "war and hams" in Slovenia.—Arnie]* The message tells of how the hams in Slovenia responded to the emergency. Most of the ham communications were helping the press (some telephone lines were broken) and the Red Cross. A lot of personal requests were handled by the hams. Most of the operations were found on 2m and 70cm FM, and a net was on 3.605 SSB.

Luckily only one ham installation was destroyed, even though many of the sites were attacked because they were TV and communication centers. Even though the 23cm backbone was disrupted by these attacks, the 2m links were ready, and the YU3 packet network remained fully operational. No harm was done to the 2m and 70cm FM repeaters.

Packet node 4N3H was probably the first ham packet node to be destroyed in a military attack. It had four antennas on 23cm to 38,400 baud YT3MV 23cm station (4N3H-12), a 2m port on 144.600 (4N3H), and a converse node 4N3H-3. They were also developing a wide-bandwidth 19,200 baud Manchester user access node on 70cm.

Writes YU3FK: "When unexpected attack of YU Army to Slovenija happened, the first hams reaction was: be QRV, stay tuned...we blocked military repeaters and simplex channels on 2m.... Later on, we were requested not to make QRM on military QRGs because we blocked channels so effectively YU3 intelligence could not get any information from military communications.

"As my role in packet, my first action was to check network. I sent a few bulletins with emergency instructions to BBSes...When army started bombing of TV and communication centers, where most packet nodes were, we prepared secondary links...."

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The conditions of issuance of a commemoration award are: Class A—6 HL call areas (HL1–HL5, and a scout 0 station) with any one of the special stations; Class B—Any HL call areas (HL1–HL5, and a scout 0 station); Class C—Only any HL stations and special station spelling "WORLD JAMBOREE" with their last suffix letter, such as, W = HL0*W*, O = HL2AK*O*, R = HL3FU*R*, L = HL4LY*L*, etc.

Needed to apply: (a) GRC list and IRCs/$5.00 (Korean station, W3,000) plus applicant's QSL card; (b) Operation period of commemorative station from 8 Aug 1991 to 16 Aug 1991; (c) Valid HL stations from 1 Jan. 1991 to 31 Dec. 1991, scout club station has no time restrictions; (d) Application deadline requirement, 31 March 1992 (effective post office date stamp).

Send applications to: Mr. Young Tee, Lee HL4CGU, Chief Team, Amateur Radio, 17th World Jamboree, P.O. Box 208, Wan Do, Jun Nam, 537-800, Rep. of Korea.

LITHUANIA

Jonas Paskauskas LY2ZZ
P.O. Box 71
Siauliai 235400
Lithuania

There were 10 special event stations operating during the 4th World Lithuanian Sports Festival from July 27 to August 15, 1991. The stations operated all bands and all modes using special callsigns of LY91??.

For those wishing to receive a commemorative pennant: in Europe you must contact at least three special event stations, and North America and other areas must make contact with at least 2 special event stations. Send your log information only and 10 IRCs to: Paul Pauliukonis, P.O. Box 321, Strafford NH 03884, USA. 73

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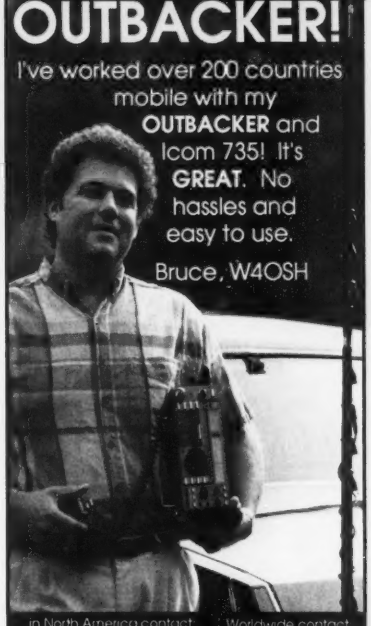

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Parts, Kits, and Scrounging

Most of the mail I receive is brief, and many of you take advantage of the mini-kits I put together. I hope this service is valuable to you. With the vast quantities of surplus material available in Southern California, I am able to obtain the components and PC board, minimizing the cost of the projects.

Sometimes the time and effort required to ferret out these items becomes a consuming burden, but the search and acquire mission built in me is quite strong. I look for items not in one's or two's, but in large quantities. The prime reason that I provide components and kits is to promote homebrewing.

I try to combine the basic starting block, a PC board, and key components at a modest cost to cover expenses. Some of the components required for these microwave and VHF projects are not easily found in your local parts store. Try to purchase a chip capacitor in almost any city, and you will meet more problems than you started with.

If you can't make it to a large hamfest like Dayton and stock up for the winter, you must depend entirely on mail-order houses or some really good scrounging. That's OK, but if you must purchase everything on a part basis, costs can be quite high.

Some of you asked about where you could purchase a small quantity of #26–36 guage wire for winding coils. I'd never given something this inexpensive a second thought. To me, this item is readily available, and I never considered how tough it could be to obtain in other parts of the country. I buy it in a scrap metal yard at $2 a pound. In the future, I will include some wire in the kits I put together, or I'll send it on request, when available. Keep in mind that I am not an electronics store, and I don't have a full stock of components; I am just trying to be helpful.

Mailbox Questions

John VE4HL, picking up an old issue of *73* and reading my column, asks an often-asked question: "Is the kit still available and the price still the same?" Bob WA4JOM asks other common questions: "Do you have a packet address?" "What are you offering the microwave explorer?" "What is the price?" George KD9EN inquires about parts: "Do you have any Gunn diodes or Gunn oscillator cavities?"

The question about price is easy to answer. The kits still cost the same. At least for the present, I haven't made any adjustments to keep pace with the increases in postal and shipping rates.

As for a packet address, I don't have a packet station on the air yet. I have neglected this mode of operation primarily due to my main interest in microwave operation.

The MOSFET (for the switching power supply) and the Gunn diodes are still available, as are most of the printed circuit boards from past projects. I make my own PC boards, and as such, have many other boards available that I have never listed before. I have a 100-year-old graphic arts camera that takes a piece of film 12" x 10", and allows me to reproduce almost anything. I also have large quantities of sheet film, and can help you prepare a negative. Drop me a line, and time permitting, I might be able to help you out on one of your projects.

The next frequently asked question is, "What is the most popular kit?" I believe it's the 30 MHz IF amplifier, Gunn modulator kit, for use with a burglar alarm type (10 GHz) Gunn oscillator and detector. It can be used directly with the MaComm Gunplexers™ unit. See the following list for the month and year of the issue that this appeared in *73*. Since then, an improved PC board has been developed, covering most of the frills while still using the TDA-7000 chip. This single chip FM receiver made this kit possible.

About this time I coined the phrase "microwave building blocks," referring to modular components used in upgrading and constructing devices. Rather than building on a motherboard, the project consisted of interconnected, easy to change modules. Most of the kits are for constructing these modules. They range from simple items to a miniature microwave RF amplifier for 10 GHz.

Kits Available

Here is a list for your convenience:

•1296 DBM (Oct. 1987). Cost, $10. The 1296 MHz mixer is a 1-1/2" square of 0.015" Teflon™ PC board. The double-balanced mixer was intended for 1296 MHz. It works well from 450 MHz to 2 GHz.

•1296 ATV Converter (Oct. 1985). Cost, $5. This simple voltage tune converter for ATV on 1296 MHz uses a single MRF-901 oscillator (the IF amplifier uses one, too).

•10 GHz Preamp (Aug. 1989). Cost, $20. The 10 GHz preamp uses two MGF-4102 GaAsFETs with a no-tune design, giving 18 dB gain at a 3 dB noise figure. This is the amplifier that I use for receive; in transmit, it drives my TWT for high power on 10 GHz SSB. An additional power supply for the preamp that uses a switch mode power supply for negative 9 volts (gate bias) is included with the PC board for an additional $5.

•60 kHz Antenna (Feb. 1990). Cost, $14. The original surplus ferrite rods for this kit are out of stock. A replacement exists, but it's full-size, instead of five rods like the original kit. The cost of the full-size rod, plus additional postage to ensure its arrival without breakage, has increased the price. With the WWV 60 kHz, the 60 kHz antenna is a calibrator for your frequency counter's timebase.

•10 GHz Fun 30 MHz IF System for Gunn Transceivers (April 1990). Cost, $10 for PC board and TDA-7000 single chip FM receiver. The 10 GHz, 30 MHz IF system is a single chip transceiver controller at 30 MHz for use with a Gunn oscillator on 10 GHz wideband FM. It controls voltages and modulation for the Funn oscillator. The TDA-7000 is a complete 30 MHz FM receiver on a single chip.

•CW EPROM Keyer (June 1990). Cost, $12.50. The CW EPROM is a keyer identifier with your callsign built in for use with a 10 GHz wideband FM system. Turn on DC power, and it outputs your call in low level audio to modulate the 10 GHz WBFM oscillator.

•FET Switching P/S (Aug. 1990). Cost, $15. Extra pair of FETs, $5. The FET switch is a simple controlled power supply that can be used to develop low power 110 AC (100W) or to construct a toroid transformer and convert 12 volts DC to 24 volts or more. It's about the size of a cigarette pack. I use one to obtain 1200 volts at 4 mA for the photo multiplier part of a laser receiver.

•5.6 GHz Converter (Dec. 1990). Cost, $15. PC board for 5.6 GHz, both receive and transmit MGF-1302 amps. Dual mixers with preamp for 2 meter IF, and transmit attenuator for transmit at 2 meter drive. Requires a local oscillator source, either crystal multiplier or brick phase-lock loop. Design by DJ6EP and DC0DA, courtesy The North Texas Microwave Society.

•6 GHz Brick PLL Oscillator (Dec. 1990). Cost, $50. The brick is a phase-locked oscillator requiring modification of its output filter. (I re-tune them for you.) The brick requires an external crystal oscillator at approximately 100 MHz. Shortly (next month) a 10 GHz PLL brick will be offered that has the internal crystal oscillator and oven control.

•Gunn Diodes 50 mW at 10 GHz (Jan. 1991). Cost, $5; 100 mW Gunn diodes at 10 GHz, $10. The Gunn diodes are still available, and the 50 mW devices are no problem. However, I am having difficulty obtaining 100 mW devices. In bench tests, I have to test about 20 devices at 50 mW before finding a hot one at 100 mW.

•10 GHz Slot Antenna (March 1991). Cost, $40. This is a beacon waveguide antenna constructed from a section of WG-16 waveguide. It produces about 6 dB gain, and is omnidirectional. The kit includes all parts, a precut and machined waveguide with top shorting end plate, and a gold plated brass waveguide (WG-16) flange.

That's the list for now. More will be added to this list in the future. I hope this answers your questions about the kits. For more information, write to me, or to *73 Magazine* for back issues or copies of the articles and columns. Better yet, subscribe and don't miss out.

On their DXpedition to Baja California, Chip N6CA and Jack N6XQ spent many evenings camped along the beach.

Recent Mailbox Question

Larry (callsign pending) has heard that it is possible to work DX at VHF and UHF frequencies by bouncing signals off the moon. He writes: "Is this true, or is someone pulling my leg?"

Many amateurs work moonbounce (or EME, Earth-Moon-Earth) from continent to continent on frequencies from 2 meters to 10 GHz. Look in the back sections of ARRL handbooks and you'll see equipment for this purpose.

Chapter 10 of *The ARRL UHF/*

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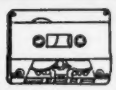

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OSCAR-22 Launched!

On July 17, five payloads were placed in low earth orbit by the Ariane space V-44 launch from Kourou, French Guiana. They included the primary payload Earth Resources Satellite (ERS-1) and four microsatellites. Among the microsats was UoSAT-F, now called UoSAT-5 or UoSAT-OSCAR-22. OSCAR stands for Orbiting Satellite Carrying Amateur Radio.

The other microsats included TUBSAT, SARA and ORBCOM-X. They were mounted on the Ariane Structure for Auxilary Payloads (ASAP). This arrangement of mounting small satellites on a ring at the base of the main payload was used successfully for the January 1990 launch of six amateur satellites, OSCARs 14–19.

TUBSAT is the first microsatellite built by the Technical University of Berlin. Its mission is to track storks (really, storks!) with radio location beacons. It also incorporates an experimental Charged Coupled Device (CCD) camera star tracker for satellite attitude determination.

SARA is a radio astronomy satellite designed to listen to Jupiter's radio emissions in the 2–15 MHz range and transmit telemetry on 145.955 MHz. This project came from ESIEE SPACE, a club at the French "'Ecole Superieure d'Ingenieurs en Electrotechnique et Electronique." Although ESIEE SPACE was originally founded to build and launch experimental rockets, the group built their first satellite in conjunction with the French National Space Agency, CNES. Some have questioned their use of an amateur frequency for the downlink, but it's up now, on the air, and can't be changed.

ORBCOM-X is a small satellite built by Orbital Sciences Corporation as a prototype of their proposed constellation of low-earth-orbit communications satellites. The team responsible for this effort included AMSAT Vice-President of Engineering Jan King W3GEY, Gordon Hardman K7KD, and Jeff Zerr. They were all pivotal players in the AMSAT Microsat Project.

A Look at UoSAT-OSCAR-22

U-O-22 is the fifth satellite in the University of Surrey series of small, low-cost spacecraft. It uses the same basic structure and electronics configuration as UoSAT-OSCARs-14 and -15 but with several differences. Originally the satellite was to have no amateur radio operations on board. Its primary mission was to provide PACSAT-style communications for medical and technical information services in developing countries on nonamateur frequencies. Organizations including SatelLife *[see "QRX" in the September issue]*, VITA, and the National Science Foundation were involved. AMSAT's former President Vern "Rip" Riportella WA2LQQ is the SatelLife Technical Director, while Jon Metzger N1IJP is the SatelLife Ground Station Manager. The HealthNet communications operation is still the primary focus of the satellite, but other experiments and ham radio operations are now a part of the package.

The U-O-22 Solar Cell Technology Experiment (SCTE) monitors the performance of a wide range of solar cells mounted on the spacecraft. Cells made from indium phosphate, gallium arsenide, and silicon are included to determine the long-term effects of space radiation on the electrical characteristics of the different cells. This will assist future satellite designers with solar cell choices for future spacecraft. The space radiation is monitored by RADFETS. The readings are then sent by the telemetry system to ground stations for study.

U-O-22 carries a CCD camera. The images are black and white with 256 grey levels and a resolution of 578 by 576 pixels. The images seen by the camera are about 1000 miles square, allowing easy identification of ground features. The pictures are captured to the onboard RAM disk for later broadcast to ground stations.

The pictures are sent via packet on 435.120 MHz at 9600 bps using Frequency Shift Keying (FSK). Image display programs were not readily available in the first days after launch, so several pictures were converted to GIF files and distributed to various BBS systems, including CompuServe and the Dallas Remote Imaging Group (DRIG) BBS (214–394–7438). Some of these processed pictures were also uplinked to U-O-14 for transmission from that satellite. U-O-22's gravity-gradient and magnetorquer attitude control system provides a stable system for reliable earth imaging. The satellite camera is always aimed toward the earth.

Ground Station Equipment

Stations already equipped for activity via U-O-14 need no changes to receive the data, messages and pictures from U-O-22. New users will need a 70cm receiver, FSK demodulator, and a packet terminal node controller (TNC) capable of KISS operation. Although 9600 bps modems are more difficult to work with compared to 1200 bps systems, more information has become available on 9600 bps systems from AMSAT both here and in the United Kingdom. Simple omnidirectional antennas are adequate for U-O-22 reception.

Several software programs have been in development for decoding and displaying telemetry from U-O-22, but the most important software is either PB.EXE or NET.EXE. These programs are designed to receive the Broadcast Protocal files sent from the satellite. They are available as shareware through BBS systems or directly from AMSAT-NA in Washington for a handling fee. Call (301) 589–6062 or write to AMSAT-NA, 850 Sligo Ave. #600, Silver Spring MD 20910-4703.

Other programs of interest from AMSAT-UK in London include DTLM.EXE for displaying telemetry from the UoSATs and microsats, SPLOT.EXE for graphing telemetry results, and UO5TLM.EXE for specifically collecting, displaying and archiving U-O-22 telemetry. Programs for picture display are expected soon. Some of these programs may also be available from AMSAT-NA.

U-O-22 Commissioning

When U-O-22 went into orbit on July 17, it was launched with all systems off. During the first pass over the United Kingdom, the ground control station powered the satellite up with the 70cm transmitter operating at the 2 watt level. Data was at 1200 bps. The onboard computer was then activated and the backup transmitter turned on because the primary transmitter was acting up with intermittant output.

After six passes over the UK, the data downlink was switched to 9600 bps and several systems including the AX.25 packet output and RAM disk were successfully activated. The previous transmitter problems were no longer occurring, and all systems seemed operational.

Forty-six hours after launch, the magnetorquers were enabled to stop the tumbling motion of the satellite. A day later U-O-22 was sufficiently stable to extend the gravity-gradient boom. Unlike previous UoSATs, where the extension of the boom is gradual, this one deploys telescopically with one firing to a length of 16 feet in only a few seconds. Gravity-gradient lock was achieved, and the satellite orientation became stable with the camera always aimed toward the earth. The magnetometer and sun angle sensors work in conjunction with the onboard attitude control software to maintain the satellite's position using the magnetorquers.

Four days after launch the ground control team began work with the CCD camera experiment. The first picture was downloaded to NK6K in California. It showed overexposure and cloud cover. Subsequent shots displayed spectacular views of the Mediterranean with excellent clarity and easily-identifiable land features. For those with CompuServe access, the first good picture file showing a clear view of Italy can be downloaded from the HAMNET as CCD1A.GIF.

By July 29, the initial phase of U-O-22's commissioning was complete. All the subsystems had been exercised and proven functional. Some debugging of the onboard computer and the CCD Transputer software continues, but for now, the amateur side of this new satellite is performing flawlessly. 73

UoSAT-OSCAR-22 Frequency Plan

Downlink:	Uplink:
435.120 MHz	145.900 MHz
9600 bps FSK	9600 bps FSK
1200 bps AFSK (backup)	1200 bps AFSK (backup)
5 watts or 2 watts	

ABOVE AND BEYOND

Continued from page 60

Microwave Experimenters Manual covers EME calculations in depth, and gives a very good history of its development and applications.

DXpedition to Baja

Recently Jack N6XQ and Chip N6CA took a trip to Baja for some DX-ing, which required some intensive navigation of Baja's narrow roads and nasty potholes, not to mention wandering burros. Jack and Chip thought they were home safe when they landed at the Tijuana airport. (They left their van in lower Baja for a return trip on July 8 for more hamming activities.) Little did they know that the most dangerous part of the trip was about to begin with a Tijuana taxi trip to the border. Jack stated that "The driver obviously had computer training, as his throttle had a binary control." They almost had two serious accidents in the very short trip to the border.

Jack reports that cautious driving rewarded them with a pleasant trip. In seven days they had traversed over 17 of Baja's 24 different grid squares. They camped on some beautiful beaches, including one in DL37 for two nights. Finding camping spots in Baja is easy, as the state is sparsely populated and forest rangers will give you directions. The Sea of Cortez was noticeably warmer than the Pacific Ocean. The last day they spent on the beach in DL53, with a refreshing breeze.

The QSO count came in around 250, with the bulk on 6 meters. Nice double hop to the East Coast on Saturday morning of the contest weekend, with strong "E's" from DL43 to Southern California, Nevada, and Arizona, on the evening of June 11. Several stations with whip antennas dropped power to less than a watt. On the 12th, operation was from Cabo San Lucas DL42 and DL52, but luck ran out and there was no opening. Camping in DL53, they caught a few more "E" openings into Colorado and meteor scatter propagation into Phoenix and W5FF. Thursday morning the 13th was the biggie, with openings into the 5, 6, 7, and Ø call areas. On the way to the La Paz airport, a few 2 meter tropo and meteor contacts were made.

One highlight of this trip was that Chip worked Bernardo XE2HWB on 6 meters, and this was Bernardo's first contact on 6 meters from his own country. Later Chip and Jack met Bernardo, his family, and Antonio XEHWH. Bernardo operates from La Paz DM44 with 10 watts and a 3-element antenna. Chip and Jack have constructed a beacon for Bernardo, and hopefully it will be operational by the end of July. The beacon will be solar powered and have 1 watt output operating on 50.008 MHz. During the solar eclipse, Bernardo operated as 4B2SOL on 2 and 6 meters.

Stay Tuned!

Next month we'll cover modification of brick oscillators. As always, I will be glad to answer questions relating to VHF/UHF and microwave areas. Please include an SASE for a prompt reply. 73

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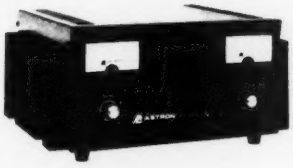

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- RIPPLE Less than 5mv peak to peak (full load & low line)
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MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• LOW PROFILE POWER SUPPLY						
SL-11A	•	•	7	11	2¾ x 7⅞ x 9¾	11

RS-L SERIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE				
RS-4L	3	4	3½ x 6⅛ x 7¼	6
RS-5L	4	5	3½ x 6⅛ x 7¼	7

RM SERIES

MODEL RM-35M

• 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

VS-M AND VRM-M SERIES

MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

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Compiled by Linda Reneau KA1UKM

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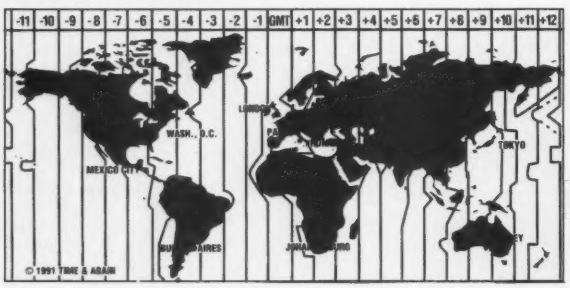
Copies of the catalog are available without charge from *American Design Components, 815 Fairview Ave., Fairview NJ 07022. Tel. (800) 776–3700; (201) 941–5000.*



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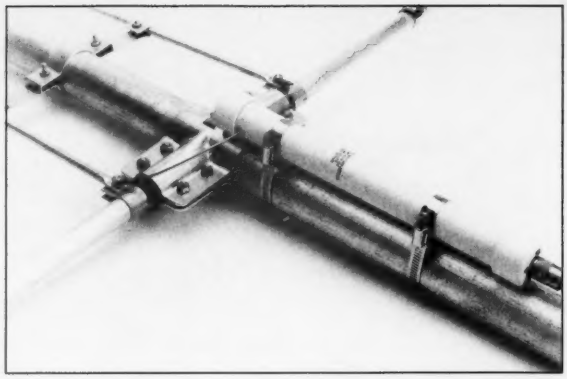

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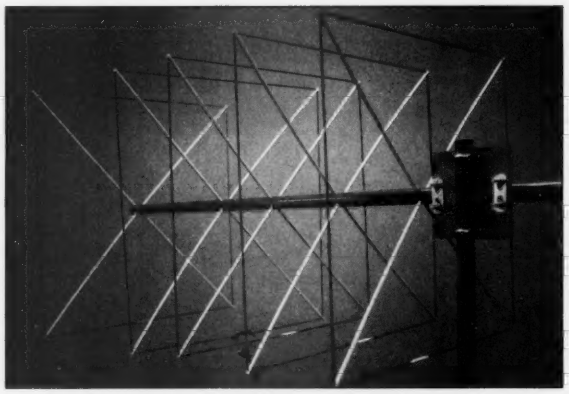

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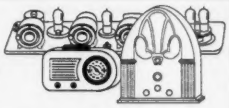

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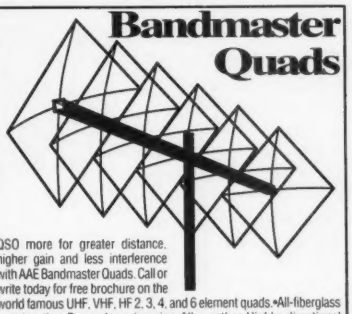

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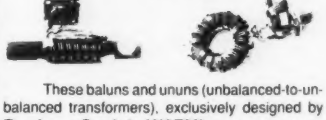

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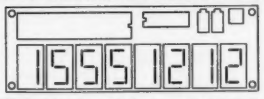

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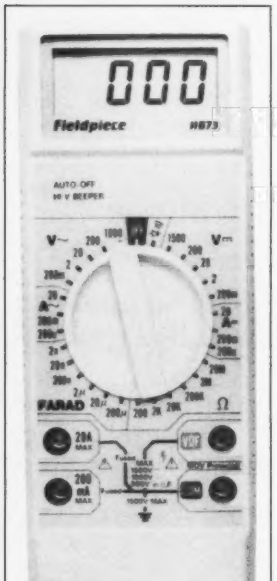

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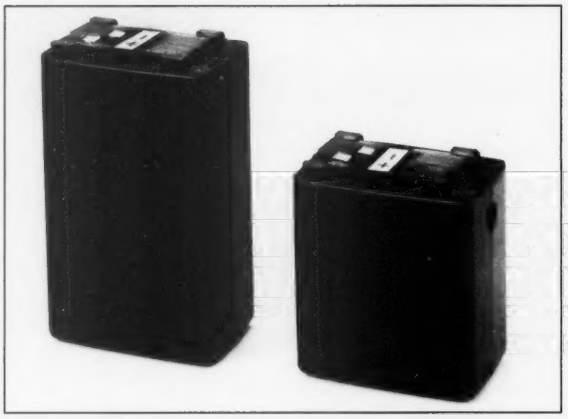
W & W Associates (Batteries "R" Us) announces the introduction of their replacement batteries for the Alinco DJ-160T/E, DJ-460T/E, and DJ-560/560E. W & W battery part #WC-500-EBP-10N is 7.2V at 700 mA. Battery part #WC-505-EBP-12N, 12V at 700 mA.

The WC-500 is $36; the WC-505 is $49. Contact *W & W Associates (Batteries "R" Us), 29-11 Parsons Blvd., Flushing NY 11354. Tel. (718) 961–2103; (800) 221–0732. Fax: (718) 461–1978.* Or circle Reader Service number 202.



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Ameritron announces the release of the new Ameritron QSK-5 Electronic T/R Switch for linear amplifiers. The QSK-5 gives you switching over six times faster than a vacuum relay, and works with any linear amplifier. The self-contained QSK-5 provides full CW break-in and rapid switching in digital modes as well as faster, quieter switching in SSB. It operates on 120 VAC, handles 2500W PEP and 2000W CW when the SWR is below 1.5:1. It handles 750W on RTTY and packet. An optional cooling fan (CF-5, $40) allows sustained operation at 1500W in any mode.

Price, $349. To locate your nearest Ameritron dealer, contact *Ameritron, 921 Louisville Rd., Starkville MS 39759. Tel. (601) 323–5869; FAX (601) 323–6551; (800) 647–1800.* Or circle Reader Service No. 203.

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Midian Electronics' new ID-1 miniature Morse Code Station Identifier sends a 16-character station ID and/or 130-character message at user-programmable intervals. The ID-1 is easily programmed via a 12-button touch-tone style keypad with alpha-numeric characters. Other programmable features include front porch delay, code speed, Morse tone frequency, bypass for PTT queing, wait period for loss of COR input, and automatic repeat intervals. If desired, the ID-1 can also send Morse code manually.

The 1.4" x 1.1" x 0.25" ID-1 costs $90. Contact *Midian Electronics Incorporated, 2302 East 22nd St., Tucson AZ 85713-2024. Orders: (800) MIDIANS. Technical Assistance: (602) 884–7981. Fax: (602) 884–0422.* Or circle Reader Service Number 207.

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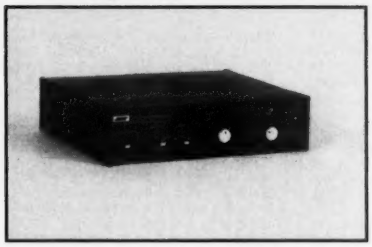

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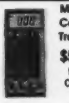
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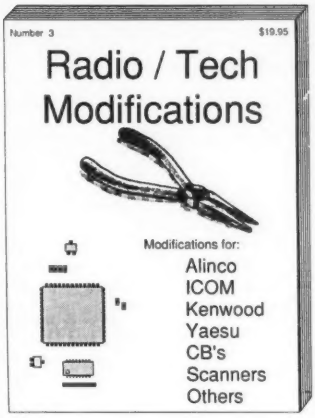

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BP-7	13.2v	500mah	$23.00
BP-8	8.4v	800mah	$21.00
BP-22	8.4v	270mah	$22.00

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FNB-10	7.2v	600mah	$15.00
FNB-11	12v	600mah	$30.00
FNB-12	12v	500mah	$30.00
FNB-17	7.2v	600mah	$18.00

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Tempo S2/4/5 Late	500mah	$21.00
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Ten-Tec BP1	500mah	$19.95
San-Tec #142/#144 Tabs	600mah	$22.00
Azden 300 Tabs	600mah	$15.00
Bearcat	600mah	$20.00
Regency MT1000 Tabs	600mah	$15.00

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FNB-11	12.0v	600mah	$52.00
FNB-12	12.0v	500mah	$45.00
FNB-12S	12.0v	600mah	$48.00
FNB-14	7.2v	1000mah	$48.00
FNB-14S	7.2v	1000mah	$59.00
FNB-17	7.2v	600mah	$35.00

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BP-7	13.2v	500mah	$60.00
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OCT 4

CAMILLUS, NY VE Exams will be held at the Town of Camillus Municipal Bldg., 4600 W. Genesee St. starting at 7 PM. Test fee for Technician through Extra class is $5.25. Talk-in on 147.300. Contact ***John Patchett KB2ERJ, (315) 487-0298.*** Please bring two forms of ID and a copy of your license.

OCT 5

GAITHERSBURG, MD A PC Fest Computer Show will be held at the Montgomery County Fairgrounds from 10 AM–4 PM. Admission is $6 for adults, children under 10 admitted free. Sponsored by ***Showa, Inc., PO Box 832049, Delray Beach FL 33483. (407) 241-1660.***

BALDWINSVILLE, NY The Radio Amateurs of Greater Syracuse (RAGS) will hold its 36th Hamfest at the Tri-County Convention Center from 9 AM–4 PM. Flea-Market set-up is 4–10 PM Fri. and 6:30–8:30 AM Sat. All indoors. Wheelchair accessible. Pre-register for VE Exams. For info call ***(315) 469-0590.*** Talk-in on 146.31/.91 MHz.

OCT 5-8

BILOXI, MS The Mississippi Coast ARA, Inc. will hold the ARRL Mississippi State Convention and 15th annual Ham/Swap Fest at Point Cadet Plaza Sat. Oct. 5 from 8 AM–5 PM and Sun. Oct. 6 from 8 AM–2 PM. RV parking. Free admission. VE Exams Sat. & Sun. (Pre-register). Talk-in on 146.13/.73 repeater. Contact ***Charlie Kunz AA5OJ, 6337 Chaucer Dr., Ocean Springs MS 39564-2306. (601) 377-6495 days; (601) 875-9516 eves.***

CHARLOTTE, NC The 40th annual Rock Hill, SC Hamfest/Computerfair will be held at the Charlotte Knights Baseball Stadium Sat. from 9 AM–5 PM; Sun. 9 AM–3 PM. Advance tickets $6 per adult, $7 at the gate, valid both days (parking included). VE Exams (by pre-registration) Sat. at 10 AM. Talk-in on 147.03 (down .600) Rock Hill repeater. For tickets and exam registration, send an SASE and make check payable to ***YCARS, 2129 Squire Rd., Rock Hill SC 29730.***

OCT 6

SPRINGFIELD, OH The Springfield Independent Radio Assn. will hold their 9th annual Hamfest indoors at the Clark County Fairgrounds, Rte. 41, just N of I-70, starting at 8 AM. Sellers admitted at 6 AM. Tickets $4 in advance, $5 at the door. Tables $7 in advance, $8 at the door. Talk-in on 144.85/145.45 and 222.66/224.26. Contact ***Ralph Pamer WA8KSS, (513) 325-1456,*** or SASE to ***SIRA, PO Box 523, Springfield OH 45501.***

HUNTINGTON, IN The Huntington County ARS will sponsor its annual Hamfest at the P.A.L. Club on Riverside Dr., from 8 AM–3 PM. Free parking. Handicap accessible. Set-up at 6 AM. Advance tickets $3.50, $4 at the door. 8' tables $5 each on a first come, first served basis. VE Exams for all classes. Talk-in on 146.085/.685 and 448.975/443.975. Contact ***Jim Covey KC9GX, 1752 Kocher St., Huntington IN 46750.***

YONKERS, NY The Yonkers ARC Ham Fair will be held from 9 AM–3 PM at the Yonkers Municipal Parking Garage, corner of Nepperhan/Main St. Admission $5, under 12 free. Flea Market space $10 per space (bring your own table). Set-up at 8 AM. No advance registration. VE Exams from 12 PM–3 PM at the 1st Precinct Police Station, E. Grassy Sprain Rd. (between Jackson Ave. & Tuckahoe Rd.). Talk-in on 146.865– or 440.15–WB2BNH repeater. Contact ***Y.A.R.C., PO Box 378, Centuck Station, Yonkers NY 10710. (914) 963-1021.***

CHERRY HILL, NJ The Mt. Airy VHF Radio Club, Inc. (The Pack Rats) will sponsor the Hamarama '91 Hamfest from 6 AM–4 PM at the Garden State Park (Rt. 70 & Cornell Ave.). Parking $1; Admission $4; Flea Market space $8. Contact ***Al Boblitt K3EOD, 8389 Langdon St., Philadelphia PA 19152. (215) 742-3312.***

OCT 12

GRAND FORKS, ND The Forx ARC will hold its annual Hamfest at the City Auditorium from 9 AM–5 PM. Talk-in on 146.34/.94. Contact ***John Engel WA6LPV, 616 8th St. SE, E. Grand Forks MN 56721.***

MINDEN, NV The Sierra Intermountain Emergency Radio Assn. will host the Sierra Hamfest/Computer Fair at the Carson Valley Inn on Rte. 395 from 9 AM–3 PM. Commercial spaces $35, individual spaces (if available), $15. General admission $3. Swap Meet will be outside, in front of the RV Park; spaces $5. Contact ***Ed Rogers W6FFT, (702) 266-3661*** or ***Duncan Insley WA6RRU, (702) 267-4223.*** Talk-in: Ask for W6FFT or WA6RRU on 147.330+ MHz.

BROOKLYN PARK, MN The 7th annual Hamfest Minnesota & Computer Expo, sponsored by the Twin Cities FM Club, Hamfest Minnesota and Computer Expo, will take place at Hennepin Technical College, 9000 Brooklyn Blvd. Free parking. Advance tickets $4.50, $6 at the door. The Expo will feature two guest speakers: Robert Locker, Jr. W9KNI, and Carole Perry WB2MGP. Double Decker Fleamarket at $12, $15, $18 per table (depending on location). VE Exams. Talk-in on 146.16/.76 repeater. Contact ***Hamfest Minnesota & Computer Expo, PO Box 5598, Hopkins MN 55343. (612) 535-0537.***

TEANECK, NJ Fairleigh Dickinson University, 1000 River Rd., will be the site of a Hamfest sponsored by the Bergen Amateur Radio Assn. from 8 AM–2 PM. Buyer's admission $2, children free. Sellers $8 per space. Free parking. VE Exams from 8 AM–10 AM, walk-in only; contact ***Pete Adely K2MHP, 13-30 Edward St., Fairlawn NJ 07410. (201) 796-6622 before 10 PM.*** Talk-in on W2AKR 146.790. For info, contact ***Jim Joyce K2ZO, 286 Ridgewood Blvd. No., Westwood NJ 07675. (201) 664-6725.***

OCT 12-13

MEMPHIS, TN MemFest '91–Greater Memphis Amateur Radio/Computer Show, sponsored by the Mid-South ARA, will be held in the Pipkin Bldg. at the Mid-South Fairgrounds. Open Sat. from 9 AM–4 PM; Sun. 9 AM–2 PM. Admission is $5 at the door. VE Exams and forms. Flea Market tables $16 per table for the weekend. Contact ***Steve Cheeseman NX3W, 4880 Cromwell, Memphis TN 38118. (901) 365-6621.*** Talk-in 146.28/.88 and 449.00/444.00.

OCT 13

E. LIMA, OH The Northwest Ohio ARC (NOARC) will hold their annual Hamfest at the Allen County Fairgrounds, Rte. 309; 1½ miles east of I-75. Wheelchair accessible. To register for Exams, send completed 610 and copy of license with check or M.O. for $5.25 to VE.Mail to ***W8TY, 1370 Stevick Rd., Lima OH 45807.*** Or phone ***(419) 336-1336.*** Tables are $8 full and $4 half table. Reservations can be made by sending SASE with check or M.O. to ***NOARC, PO Box 211, Lima OH 45801.***

WEST FRIENDSHIP, MD The Columbia ARA, (CARA), will hold a Computer Show, Electronic Expo and Amateur Radio Convention at the Howard County Fair Grounds (off Rte. 144), from 8 AM–3:30 PM. Outside Flea Market/Tailgating space $10 per space; includes 1 general admission. General admission $5 (spouse and children free). 1–4 tables $20 each; 5 or more $18 each (includes 1 vendor admission per table). Contact ***CARA Hamfest Committee, PO Box 911, Columbia MD 21044. (301) 531-2933.***

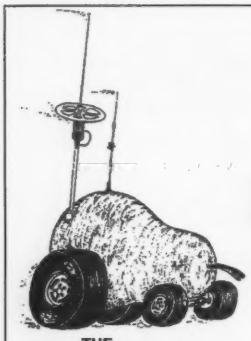
WALL TOWNSHIP, NJ The 4th annual Shore Area Ham/Computerfest, sponsored jointly by the Jersey Shore ARA, Neptune ARSA, Ocean-Monmouth ARC, and the Garden State ARA, will be held at the Allaire Airport, Rte. 34, from 0800-1600. Set-up at 0600. Parking for cars and aircraft. Advance tickets $5, $6 at the gate. XYL's and kids under 12 admitted free. Tables $20, inside hanger with power available. Tailgating spaces $10 each. VE Exams. Talk-in on 145.110 KC2Q, for cars; UNICOM 123.00 MHz, for aircraft. For reservations contact ***Shore Area Hamfest, PO Box 635, Eatontown NJ 07724-0635.*** For info call ***Al Jackson NK2O, (908) 922-8121.***

OCT 19

GRAY, TN The 11th annual Tri-Cities Hamfest, co-sponsored by the Kingsport, Bristol, and Johnson City Radio Clubs, will be held at the Appalachian Fair Grounds located off I-181. RV hookups. Admission $5. Mail inquiries to ***PO Box 3662 CRS, Johnson City TN 37602.***

AUGUSTA, GA The ARC of Augusta GA will sponsor the Augusta Hamfest/Computer Fair at the Augusta-Richmond County Civic Center from 9:30 AM–5 PM. Advance Tickets $4, $5 at the gate. Kids 12 and under free. Dealer tables $10 each plus admission ticket. Set-up starts at 6:30 AM. For reservations contact ***Roy Hillis N4VSN, Rte. 1, Box 58, Girard GA 30426. (912) 569-4261.*** Tailgating space free with admission ticket. WCARS/VEC Exams at 10 AM. For info contact ***Jim Abercrombie N4JA, PO Box 5943, Augusta GA 30906. (404) 790-7802.*** Talk-in on 145.45, alternate 145.49.

COTE ST. LUC, (MONTREAL) QUEBEC, CANADA The Cote St. Luc ARA will sponsor Hamfest '91 at St. Richards Church, 7070 Guelph Rd., from 9 AM–3 PM. Flea Market set-up at 8 AM.



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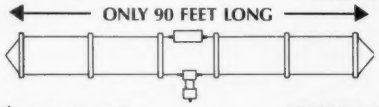

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GARWOOD, NJ The TCRA Hamfest/Flea Market, sponsored by The Tri-County RA, will be held at St. Anne's School on Cedar St. from 8 AM–2 PM. Donation $3, children under 12 (with parent) free. Reservations required for tailgating. Walk-in VE Exams start at 9:30 AM. Bring check for $5.25 payable to "ARRL VEC" (except for Novice Exam), your original license (plus Xerox copy if you want to keep your original), 2 forms of ID, pencils and a pen. Tables $8, $10 with AC. Contact ***Dick Franklin W2EUF, 23 Shawnee Rd., Cranford NJ 07016. (908) 276–6522.*** Talk-in on 147.255/.855 and 146.52.

TACOMA, WA The Radio Club of Tacoma will sponsor its 2nd annual Electronics Flea Market from 9 AM–3 PM at the Camp Murray Armory (exit 122 West, off Interstate 5). Free parking. Overnight parking $2. Admission $3, children under 13 free. VE Testing at 10 AM (walk-ins ok). Talk-in on 147.98/.38. Call ***Ken Moak WA2JQW, (206) 581–6494*** or write to the ***Radio Club of Tacoma, PO Box 11188, Tacoma WA 98411.***

OCT 19-20

EL PASO, TX The International Hamfiesta will be held at the El Maida Shrine Temple Convention Hall, 6331 Alabama St., Sat. from 8 AM–5 PM, and Sun. from 8 AM–3 PM. Tickets $5 in advance, $6 at the door. Tables $5. Tailgate spaces $5 each. VE Exams both days. RV parking. Talk-in on 146.88 repeater. QCWA Breakfast. Contact ***Chris Hines N5LZB, Box 31628, El Paso TX 79931. (915) 584–3824.***

OCT 20

CAMBRIDGE, MA A TAILGATE Electronics, Computer and Amateur Radio FLEA MARKET, co-sponsored by the MIT Electronics Research Society, the MIT Radio Society, and the Harvard Wireless Club, will be held (rain or shine) from 9 AM–2 PM at Albany and Main St. Free off-street parking. Tailgating. Sellers $5 per space in advance, $8 at the gate (includes 1 admission.) Set-up at 7 AM. Mail reservations before Oct. 5th to ***W1GSL, PO Box 82 MIT BR., Cambridge MA 02139.*** For info call ***(617) 253–3776.*** Talk-in on 146.52 & 449.725/ 444.725–pl 2A–W1XM repeater.

BENSALEM, PA The Penn Wireless Assn. will sponsor the 3rd annual Tradefest '91 at the Yezzi Athletic Field on Rte. 513 (1 mile south of Rte. 132) from 8 AM–2 PM. Set-up at 6:30 AM. Outdoor tailgating. VE Exams. Admission $3, $7 per carload, kids 12 and under free. Flea Market spaces $5. Premium or multiple spaces guaranteed by advance payment. For advance sales, send checks w/SASE to ***PWA Tradefest '91, PO Box L-734, Langhorne PA 19047.*** Talk-in on 145.25/ –0.6 and 146.52 simplex. Contact ***Steve, (215) 752–1202.***

KALAMAZOO, MI The Southwest Mich ART and the Kalamazoo ARC will co-sponsor the 9th annual Kalamazoo Hamfest at the Kalamazoo Central High School, starting at 8 AM. Set-up at 6 AM. Directions: US 131 to M-43, east to Drake Rd., then north to the school. Free parking. Advance tickets $2, $3 at the door. Tables $1/ft, $4 minimum. Send requests and payment with SASE before Oct. 13 to ***Gary Hazelton KB8PL, 67332 32nd St., Lawton MI 49065.*** Make checks payable to Kalamazoo Hamfest.

CENTRALIA, IL The Centralia Wireless Assn., Inc. and Kaskaskia College R.E.A.C.H. Club will co-sponsor a Hamfest at the Kaskaskia College Gymnasium, Shattuc Rd., beginning at 8 AM. Set-up at 7 AM. Free parking. Flea Market space w/1 table, $5. Admission/Main Prize tickets are $2 each or 3/$5. Mail ticket orders with an SASE to ***Centralia Wireless Assn., Inc., Hamfest Tickets, PO Box 1166, Centralia IL 62801*** Talk-in on 147.27/.87 and 443.2/448.2. For info contact ***Bud King WA9U, (618) 532–6606,*** or write to ***CWA, Inc.*** at the above address.

TUCSON, AZ The 4th annual Tucson Hamfest, sponsored by the Old Pueblo Radio Club, will be held at the DeAnza Drive-In, from 7 AM–1 PM. ARCA Meeting. Sellers $4 per space, Buyers $1. Talk-in on 146.22/.82, 146.28/.88, 146.52 simplex. Contact ***A.J. Pawlowski KB7KZ, 3418 W. Green Trees Dr., Tucson AZ 85741. (602) 742–2605.***

OCT 26-27

WEST PALM BEACH, FL The Palm Beach Repeater Assn. will sponsor the Palm Beach County Hamfest Amateur Radio/Computer Show Sat. from 9 AM–5 PM, and Sun. 9 AM–3 PM. at the South Florida Fair Grounds Expo Center. Set-up is Fri. from 2 PM–8 PM. Free parking. RV full-hookup sites. FCC Exams begin at 9 AM both days. Advance tickets $4, $5 at the door. Tickets are valid both days. Flea Market tables are $15 in advance, $17 at the door, if available. Tables valid both days. Talk-in one hour before Hamfest hours and one hour before set-up hours, on 147.165/ .765 repeater with 146.520 simplex for close-in work. Contact ***Vi Klekenapp KC4LCF, (407) 585–9074.***

CHATTANOOGA, TN The 13th annual Hamfest Chattanoga Amateur Radio Convention (an ARRL sanctioned Hamfest) and ARRL Delta Division Convention, will be held in the South Hall of the Chattanooga-Hamilton County Convention and Trade Center. ARRL/VEC Exams given both days at 9:30 AM ($5.25). Send 610 form, check or MO, and copy of license with any instant-upgrade info for all exams to ***Bill Wiggins N4BMR, PO Box 23121, Chattanooga TN 37422,*** by Oct. 22nd. Please specify either Sat. or Sun. as desired exam date. No walk-ins. Bring original license and positive ID with you. Flea Market tables are $10 per day, $15 per weekend; electrical power is $25 extra. For Flea Market info call ***Frank Gray KC4TV, (615) 899-7917*** between 6 PM and 10 PM only. Talk-in on 146.19/.79. For Hamfest info write to ***Hamfest Chattanooga, PO Box 3377, Chattanooga TN 37404.*** For exhibitor info call ***Barbara Gregory WA4RMC, (615) 529–7911*** during work hours, or ***(615) 892–8889*** eves.

OCT 27

SELLERSVILLE, PA The RF Hill ARC will sponsor a Hamfest at the Pennsylvania National Guard Armory, PA Rte. 152, starting at 0800. Set-up at 0600. Admission $4. Talk-in on 145.310, 146.880, 146.520 simplex. VE Exams. Indoor and outdoor Flea Market. Contact ***Bob Buonfiglio WG3X, 361 School House Rd., Souderton PA 18964. (215) 723–1016 eves. 1800–2200.***

MARION, OH The Marion ARC will hold its 16th annual Heart of Ohio Hamfest/Computer Show from 0800–1500 hours at the Marion County Fairgrounds Coliseum. Tickets $3.50 in advance, $4.50 at the door. Tables $7. Talk-in on 146.52 simplex or 147.90/.30 repeater. Contact ***Dan Burns N8JMF, 844 Robinson, Marion OH 43302. (614) 382–2384.***

SPECIAL EVENT STATIONS

NOV 2–3

CHARLOTTE, NC The new Amateur Radio Education Center at the Discovery Place science museum will celebrate its opening by operating from noon (Eastern Time) Nov. 2–noon Nov. 3. The Mecklenburg ARS will operate the station as W4BFB, primarily on phone in the bottom 50 kHz of the General phone subbands on 75, 40 and 20 meters and around 28,400 kHz. For QSL and Certificate, send QSL card and 9x12 SASE with 2 units of first class postage to ***Ralph Eubanks, 6021 Coatbridge Lane, Charlotte NC 28212, USA***

OCT

VERMONT Special Event Stations from Vermont will be operating 25 kHz up from the bottom of the Novice and General bands to help celebrate Vermont's 200th Birthday. RTTY/AMTOR etc. will be in the digital subbands. To obtain a Special Bicentennial Certificate, send $1 and a SASE to ***Amateur Radio Bicentennial Project, PO Box 200, Graniteville VT 05654.*** Foreign stations, send only SAE and IRC's to cover postage.

OCT 5

OZARK, AL The Dale County ARES will operate WD4NXN 1400Z–2300Z to commemorate the annual Claybank Jamboree Arts and Craft Show. Operation will be in the 40, 20 and 15 meter General HF subbands and the Novice 10 meter phone band. For QSL, send contact number and SASE to ***Special Event, WD4NXN, 208 Cherry Lane, Ozark AL 36360-2811.***

OCT 5–6

CAPE COD, MA WB1U will be operating from the Marconi Wireless Station site at South Wellfleet (starting 1400Z) to commemorate its 90th Anniversary (construction started in 1901). Frequencies: General portions of 15, 20, and 40 meters (lower 25 kHz) and the Novice portions of 10 and 80 meters. For Certificate, send QSL and 9x12 SASE to ***Ray Hilson, 6 Sherman Place, Norwalk CT 06851.***

PITTSBURGH, PA The Breezeshooters ARC will operate W3XX from the USS Requin SS481, a Trench Class WWII submarine, from 1400Z–2200Z each day, to celebrate the opening of the Carnegie Science Center. Frequencies: 28.495, 21.385, 14.245. For a QSL card send an SASE to ***WB3LHD, 326 Sunset Dr., Bethel Park PA 15102.***

BRUNSWICK, MD The Brunswick Radio Amateur Groups are planning special event operations for the annual Brunswick Railroad Days Celebration. Brunswick Hams will be signing with location on phone and "/BSWK" on CW from home QTHs and the festival grounds. Frequencies: 28.300/ .325 MHz (SSB) in the daytime; 14.250/.265 MHz (SSB), 7.100/.115 MHz (CW) and 3.675/.700 MHz (CW) evenings and overnight, plus local VHF and UHF. For a commemorative photo QSL of Brunswick Museum's Centennial Quilt, send QSL to ***BRAGS, PO Box 143, Brunswick MD 21716.***

OCT 12–13

QUILCENE, WA The West Seattle ARC will operate Station W7AW during the "Quilcene Slug and Oyster DX Festival" from 1600 UTC–0400 UTC Oct. 12 and 1600 UTC–1900 UTC Oct. 13. Frequencies: 7.225, 14.225, 21.125. For a commemorative QSL Certificate showing a friendly slug and oyster at play, send QSL and a large SASE to ***B. Todd, 3719 59th Avenue SW, Seattle WA 98116.***

COLUMBUS, OH The Columbus ARA will operate Station W8TO in conjunction with the Columbus USA Festival, from Oct. 12 at 0000 UTC–2400 UTC Oct. 13. Frequencies: 7.240, 14.340, 21.375, 10m Novice phone band. A commemorative QSL is offered to those who confirm contact with W8TO. A Certificate will be sent to stations who contact at least 10 Columbus area stations. Plaques will be awarded to the two stations making the most contacts. Exchange name, QTH and signal report. Send QSLs and logs to ***Roger Dzwonczyk WB2EIG, 283 East Longview Ave., Columbus OH 43202, USA.***

ROBINS AFB, GA The Middle Georgia RA will operate KN4IE from the Museum of Aviation from 1200Z–2000Z to remember and preserve aviation history on the 44th Anniversary of the breaking of the sound barrier. Airpower or aviation notables may be on the air for this event. Frequencies: (SSB) 3944, 7244, 14244, 21344, 28344; (CW) 3644, 7144, 14144, 21144, and 28244, QRM/QRN permitting. For a unique QSL card and/or certificate signed by World War II Ace and *God is My Co-Pilot* author BGen. Robert L. Scott, Jr., Retired, QSL with SASE to ***Dave Shiplett WL7ACY, PO Box 1076, Warner Robins, GA 31099.***

OCT 18–19

GILMER, TX Hams of Upshur County will operate N5QZK in conjunction with the 54th annual East Texas Yamboree. Operation will be in the General portion of the 40 and 20 meter phone subbands, and in the Novice 10 meter phone subband. For a certificate send QSL and a 9x12 SASE to ***KB5PAD, Rte. 2, Box 114, Diana TX 75640.***

OCT 18–20

UNION, KY The Northern Kentucky ARC will operate K4CO 1400–2100Z from Big Bone Lick State Park in conjunction with the annual Salt Festival. Operation will be on 40, 20, 10 meters, and 147.375+ repeater. For a certificate, send 4x9 SASE and contact number to ***NKARC, PO Box 1062, Covington KY 41091.***

OCT 19

ALCATRAZ ISLAND/PRISON The Sacramento ARC will operate from the Officer's Dining Hall of Alcatraz Prison 1700–2300 UTC. Three transmitters will be on SSB frequencies 7.240, 14.280, 21.350 and 28.350 as best propagation permits. QSL with SASE to ***S.A.R.C., PO Box 162903, Sacramento CA 95816.***

WEST LAFAYETTE, IN The Purdue ARC will operate W9YB from the campus of Purdue University 1400–2200 GMT, to celebrate Homecoming Weekend. Frequencies: 7.280, 14.280, 21.380, and 28.480 MHz (±20 kHz) during the day as propagation and QRM allow. W9YB, located in the West Tower of the Purdue Memorial Union, is open to campus visitors at this event.

OCT 19–20

ATHENS, GA The Athens RC will operate WA4BKF to celebrate Athens' most unusual property owner, the "Tree That Owns itself." Operation will be in the General portions of the 80–15 bands and Novice 10 meter. For special QSL, send QSL and No. 10 SASE to ***Bill Strickland WA4FVT, 355 Segrest Cir., Athens GA 30605.***

OCT 23–25

NEW YORK CITY, NY The "22 Crew" operating WB2JKJ from the HQ of the Radio Club of JHS 22 will celebrate the 11th anniversary of the Club and their educational program EDUCOM. Join them on 7.238 from 1200–1330 UTC then on to 21.395 till 2000 UTC, Wed. thru Thurs. For an awesome QSL and surprise package, write to ***RC of JHS 22, PO Box 1052, New York NY 10002,*** or FAX it to us at ***(516) 674–9600.***

OCT 31–NOV 1

BREVARD, NC The Transylvania County ARC will operate W4EHV to celebrate Halloween from the Devil's Courthouse in Transylvania County. Operating hours will be from Oct. 31 at 2100Z–0200Z Nov. 1. Frequencies: (SSB) 3.860, 14.295, 21.365, 28.335, 50.150, 144.25; and 146.52 FM Simplex. VHF Packet, KN4GC V NCAVL2.NC. For certificate, send a legal size or 9x12 SASE to ***W4EHV, Erik Hansen, PO Box 10, Sapphire NC 28774.***

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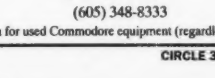

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Continued from page 46

capacitance, and set both switches to about the center of their ranges.

With the transceiver adjusted for a few watts output on CW, key the transceiver and adjust both wafer switches for the lowest SWR indication. Then, adjust C1 while changing the position of one or both wafer switches, one position at a time, until the SWR is as low as possible. This usually will be 1.1:1 or lower with most installations.

There may be more than one pair of switch positions which produce an SWR below 1.5:1. Although 1.5:1 is satisfactory for all modern transceivers, changing one or both switches a single position one way or the other should allow adjusting C1 for an even lower SWR indication.

Although it may be necessary to change the positions of the wafer switches when going from one end of 80 meters to the other, on the higher bands a slight adjustment of C1 should allow the SWR to be brought back to 1.1:1.

Conclusion

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Frequency Specification

Boy, did I open a can of worms a few months ago! Last July I asked for your opinions on specifying RTTY frequencies.

To recap the problem, for those who may have come in late, the question was raised as to whether the mark, the space, or somewhere in between, should be used to specify the frequency of a RTTY signal.

Edwin R. Ranson K5ER of Mustang, Oklahoma, writes: "The question of how to specify an amateur HF digital signal's frequency has been kicked around at least as long as I have been on digital modes, and that's since 1966. Back then, it was pretty standard to specify the mark tone as the operating frequency, but that was before the days of digital readouts and frequency counters becoming so common. We were lucky to know our operating frequency within a kHz (in those days, a kHz was called a 'kc').

"I can tell you how the military and the NTIA (the Federal Government's equivalent of the FCC) specifies frequencies. It is the center frequency of the occupied spectrum. For example, for a voice upper sideband SSB emission, the assigned frequency would be 1.5 kHz above the (suppressed) carrier frequency, since the signal occupies the spectrum between the (suppressed) carrier frequency and the carrier plus the highest modulation frequency. (Voice bandwidth is considered 3.0 kHz wide.) So, if your carrier frequency is 14.300, the assigned operating frequency would be 14.3015. For CW, FM, and AM modes, the center of the occupied spectrum is the carrier frequency, so the assigned frequency and the carrier frequency would be one and the same.

"The same method is used for all emission types, including FSK modes. So, if your mark is on 14.070, that puts your space on 14.06983 (with a 170 Hz shift, with a low space frequency), and your operating frequency is 14.069915. What's the dial read on your transceiver? Depends on the scheme you are using, and, if you have a RTTY mode, the scheme the manufacturer used. Confusing? Not really for channelized operation. Figure it out once, program it in, (or order the right crystal) and you're there.

"But for the way we amateurs operate, that method leaves something to be desired. Personally, I think it makes more sense to specify the mark frequency as the "operating" frequency, because that's something you can measure with a counter. Since there are several different modulation schemes, the standard should be the lowest common denominator. Whatever we use, there should be some sore of standard, so when you want to find the station who said he would be on 14.074, there is an unambiguous understanding of what that number means."

Another opinion was proffered by Kit Kohlmoos W6ISO, whose work we have enjoyed as well in these pages. Kit writes, "I suggest that you consider what the FCC monitoring station will hear [to] determine the answer. When I am setting my frequency close to a band edge, I always calculate the extreme limit of my transmitted sideband in the direction of the band edge, then I set the transmitter frequency so that there is at least a 1 kHz guard band beyond the limits of my signal.

"It's obvious, therefore, that with AFSK the operator should center the indicated frequency about 4 kHz inside the lower band edge if the shift is down, and vice versa if [he's] near the upper band limit and shifting up."

As if not to be outdone, the August 1991 issue of *QST* carries an article on page 28, entitled "What Your Frequency Display Really Tells You." Covering much of what we have brought up, asked about, and speculated upon, this five-page article answers some questions, raises a few more, and fleshes out the topic nicely. It's good reading, and I recommend it to anyone who is interested.

On the flip side, Kit is looking for an "elementary cartridge and interface . . . to put a C-64 on RTTY, AMTOR, and CW." He's been running a Sinclair ZX81 with software by AF8J and a home-brew interface, but finds it subject to occasional strange tricks which he supposes are due to "RFI, punching the wrong key, or just the whims of nature."

A related question comes from J.R. Popkin-Clurman VE7YT of Ganges, B.C., who is another C-64 owner. He writes that he ". . . recently acquired a Commodore 64. I have had a Kantronics UTU a number of years, but have never tried to use it until now.

"I would greatly appreciate it if you will tell me how to marry the Commodore 64 and the UTU so I can use it for AMTOR. I am presently on RTTY using a 28KSR with an ST5000."

Segueing into AMTOR, a Mr. Felsenfeld from Yorktown, New York, is looking for some introductory texts and current newsletters on AMTOR.

For all these, I turn the floor open to you all. While I recall a number of simple cartridges and the like for the C-64 in years past, I have no idea if these are still available. A company called Microlog, located here in Maryland, produced one such device. I can find no trace of Microlog at present.

As to texts, I really know of no single source other than those reviewed in this column in the last few years. Readers (and authors) aware of such material are also invited to keep me posted on new developments in the field of published information.

Try a New Band

And finally, a proposal. David Ovad NP2H of Blairstown, New Jersey, writes that, "...in reading 'RTTY Loop' in the August issue of *73*, I find myself in full agreement with William Martin N7EU. I also have found little AMTOR activity on either 30 or 40 meters. I will sometimes call CQ many times on 30 meters especially, only to find no one is on the band. I know the band is open as I use it to log on to NØIA (APLINK) on 10.1405. When I do find a QSO, the other person is as surprised as I am to find activity.

"Maybe we should declare Thanksgiving weekend an HF digital 'Try a New Band' weekend. I say let's give 20 meters a little breathing room. With the sunspot cycle declining, 7 and 10 MHz will become more and more valuable, propagation-wise."

As they say, Dave, "Use it or lose it!" Our dear Wayne has been promoting wider band use for years. Maybe it's about time we listened to him.

More on tap for next month, including more software, and more input from you all. Keep me posted on your digital activities, and let me know what you think of a digital Thanksgiving. Drop me a note at the traditional mail address above, or CompuServe (75036,2501) or Delphi (MARCWA3AJR). I'll be listening! 73

Number 21 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Hamhelp SIG. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 525–4438). Use upper- and lowercase letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Thank you for your cooperation.

The Commodore/Vic-20 Ham Radio User Group has software for trade. Shareware or public domain ham-radio-related software only. All disks are on 5¼" format. Donations to the library are welcome. Write to *Howard S. Bacon KC4CIQ, 213 Holly Ave., So. Pittsburg TN 37380.*

WANTED: Any kind of HF, UHF, or VHF radio equipment that you no longer need. This is needed to help get a now-defunct high school ham club back on the air. Please help by donating to *Roger Bacon H.S. Ham Club W8MTM, c/o Dan Gettelfinger N8NTL, 8623 Pringle Dr., Cincinnati OH 45231.* Thank you.

NEEDED: Manual/schematic for EICO 369 Sweep Generator. I will pay for the effort. *C. Chadwick N4GTX, PO Box 1381, Palatine IL 60078. (708) 358–3603.*

WANTED: Schematic for Drake Model 2C Receiver. I will pay copying and mailing costs. *Larry Keith KF8BX, 4251 Meadowsweet Dr., Dayton OH 45424. (513) 233–1148.*

My husband is in the Air Force so I am studying for my Novice license while stationed in the Netherlands. I'm a complete beginner and would appreciate a "ham radio pen pal" to help me along. *Mrs. Suzanne Dickerson, 32CSG, PSC 75 Box 1726, APO AE 09719.*

Pastor of small country church desires to communicate with missionaries in Brazil and Mexico, but is on a limited budget. If you have an older HF rig gathering dust, can you help? Contact *Pastor Michael Crowell N5UJA, 4510 FM 1954–Rt. 6, Wichita Falls TX 76301. (817) 322–4606.*

Any MILITARY/DOD active or retired Hams wishing information on operations in Germany, (frequencies, equipment, license requirements, etc.) send SASE to *Robert Dickson Ret., PSC 1 Box R-4988, APO AE 09009-4988.*

Members of the Oregon Region Relay Council continue their drive for funds, to donate a fully operational 2m repeater to the Khabarovsk Amateur Radio operators of the Soviet Union. The Khabarovsk area of the Soviet Union does not currently have any repeaters. Please send donations to *Oregon Region Relay Council Inc., P.O. Box 25451, Portland OR 97225-0451.*

I would like to be in contact with other hams who enjoy on-going role-playing games. If you are interested in joining, write me and let's set up a sked. *Doug Brown KC4RSL, Rt. 4, Box 538, Commerce GA 30529.*

WANTED: A copy of the manual for the Heath SB-630 Station Console. *Bob Schlegel N7BH, 2302 286 St. E., Roy WA 98580.*

I would like to purchase copies of *Popular Electronics* and *Electronics Illustrated* magazines which were published between 1963 and 1983; also schematic/data on a Royce Model I-406 H-T 5W transceiver (manufactured Apr. 1977). Thank you. *R.E. Cassels KA5JTX, P.O. Box 11, Atoka OK 74525.*

I am requesting an operator's manual for the Yaesu FT-209RH 2-meter. I will pay copy and postage costs. Thank you. *Vicente Lopez NP4MZ, 60 Moore St.–5J, Brooklyn NY 11206.*

EROC, the Environmental Radio Operator's Coalition, has started a net on 14.330 MHz every Saturday at 1900Z. The EROC net is designed to promote goodwill between amateurs and to promote environmental awareness through the friendly discussion of topics. This net also handles traffic. Please join us in a cause worthy of amateur radio's use. If you are interested in helping the EROC directly, write the net manager, *Greg Beaver N8LAI, 184 Maplewood Dr., East Lansing MI 48823, or call (517) 351–7785.*

WANTED: Schematics only, for Galaxy GT-550, and/or power supply AC-400 and RV550 VFO. I will pay for copying and postage. *Stephen Brzoska N2MHQ, 27 Willow St., Washington NJ 07882.*

I am requesting an operator's manual for the Yaesu FT-209RH 2 meter. I will pay copy and postage costs. Thank you. *Vincent Lopez NP4MZ, 60 Moore St., 5J, Brooklyn NY 11206*

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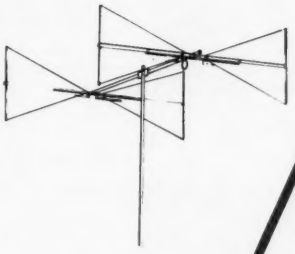

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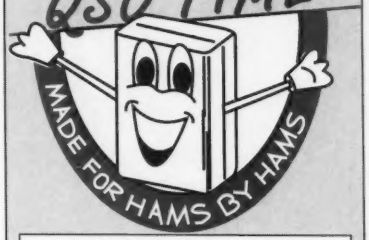

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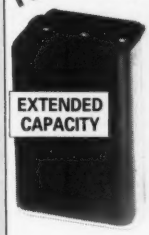

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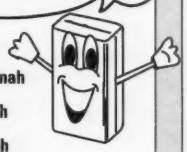

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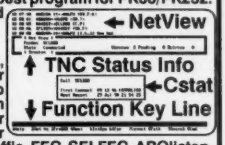

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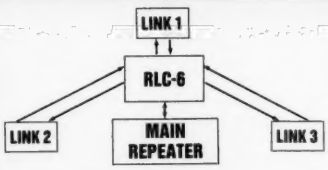

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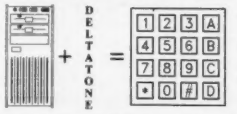

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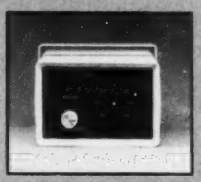

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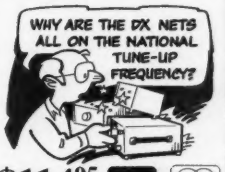

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HW-9 Thump Suppressers

The mail has been running heavy lately since the word has gotten out the HW-9 is no more. Take it from me, if you hear of or get a catalog in the mail from Heath with the HW-9 listed for sale, they're all gone. What units Heath did have were sold at the Dayton Hamvention in no time. If you're lucky enough to have an HW-9, we might as well do a little bit of fix up work on it.

When the HW-9 goes to transmit, the audio line is shorted to ground via Q303, resulting in a rather loud thump. Jack Lau KH6CP has a simple and easy fix to suppress this thump. He just added a JFET in series with the audio line. Instead of grounding the audio, he opens it up. A lot of HW-9s have Zack's thump suppresser installed.

Another version of the thump suppresser comes from Paul Levesque KB1MJ. Instead of using a JFET to open the audio line, Paul used a 4066 CMOS chip (see Figure 1). This chip has several switches inside. By wiring up the different switches, he mutes the audio while at the same time creating an opening in the audio line. This chip also eliminates the thump from the HW-9's audio. See the schematic for more details.

Bandwidth Improvement

Paul has also improved the HW-9's excessive bandwidth. He writes:

"Perhaps the most annoying fault in the Heath HW-9 is its excessive 3 kHz bandwidth and the desensitizing of the receiver via AGC driven by strong signals in the passband.

"I've been quite successful with the 400 Hz, 3-pole crystal filter suggested by Wes Hayward when driven with a high gain FET in order to simplify the required changes. I can now operate on 40 meters at night, a feat found to be impossible with the original design. See Figure 2.

"I have purchased a small quantity of crystals and have matched them very closely in sets of three in order to provide optimum filter performance. Three crystals and the two 680 pF capacitors I have mounted to a small PC board create a 'drop-in replacement' for the original Heath filter FL301. A high gain FET from the J308 family provides a direct substitute for Q301, and increases the IF gain. A small toroidal transformer established the impedance match between the FET and the input of the crystal filter.

"I can provide a limited number of complete parts kits with step-by-step instructions for this conversion to the HW-9 users who are interested in improving the selectivity and AGC function of their transceivers. Keep in mind you'll forfeit the ability to copy SSB with this modification. The cost of the kit is $26. Write me a note if you are interested in more details. Should the demand exceed my supply, orders will be honored in the order received." Write Paul Levesque KB1MJ at 14 Wesley Street, Dedham MA 02026. Don't send your letters to me; route them to Paul for the filter modification.

Calming the Transmitter

I've received several letters and even some phone calls about transmitter instability in the HW-9. There is really no one fix, but rather several fixes that *might* cure the instability. Some HW-9s, like the one I owned, exhibit no instability. I think some cases of instability may be traced back to how the rig was assembled.

When there is instability, it seems to occur mostly on the 15 and 10 meter bands. Adjusting the drive above 3 watts on 10 meters will slam the meter all the way over. This is a good indication of instability. If you have a high SWR on a resonant antenna, but a good SWR into a dummy load, you've got instability problems, too.

Several fixes may help you calm down your HW-9. First, re-solder the PA components as close to the board as possible. Excess lead length will cause problems. Also, change Q402 to a 2N4401 transistor. Since the circuit seems to be quite sensitive to transistor parameters, more than one might have to be tried. In real stubborn cases, try changing C434 to a slightly smaller value. Check the temperature of the PA's heat sinks. If one is really hot, and the other is cold, you might have one dead final transistor. This makes the other one work harder, upsets the design parameters of the PA stage, and results in transmitter instability. Both heat sinks should be comfortably warm after a five minute QSO.

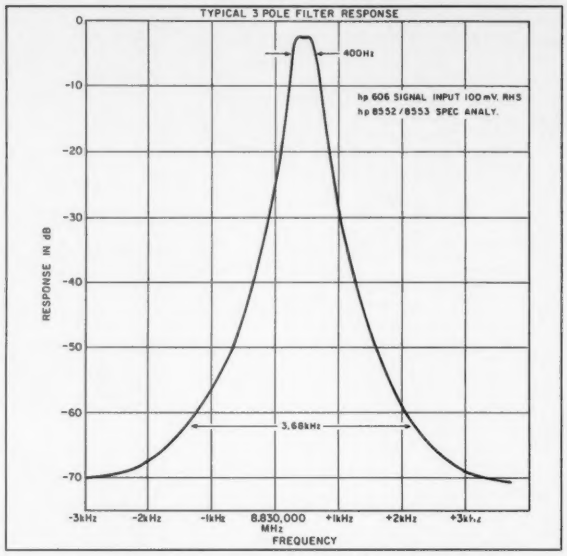

Figure 2. The audio response with the KB1MJ crystal filter circuit.

The driver stage, Q404, uses inverse feedback in the form of R414 and C432. To reduce the drive, decrease the value of R414. Go down in small amounts; you don't want to reduce the drive to the point of reducing the power output. These "fixes" should calm down the HW-9's transmitter.

Looking for Trouble

Now, what about the HW-9 that will only put out one watt? Try inserting an ammeter in series with the supply leads. If the input current is excessive, with little RF being produced, your best bet is to start looking at diode D407 for the source of the trouble. If the diode goes bad, almost all of the power from the transmitter goes to transformer T404. Nothing bad happens, but you'll only see a watt or two on any of the bands.

Some of the modifications you may have done to improve the sensitivity of the HW-9's receiver call for replacing the diodes in the front end T/R switching scheme. The diodes are low power Shottky diodes. If you have replaced D407 with the Shottky diode or the recommended HP 5082-2835 diodes, D407 will fail. Diode D407 requires at least a 50 volt rating. There's a lot of RF across it during transmit.

Since Heath has dropped the entire line of ham kits, many of you have written to me, asking for schematics for the HW-7, HW-8, and the HW-9. Heath will still sell you a copy of the HW-7 manual for $17.50. Manuals for the rest of the QRP rigs should also be available. I don't know about parts. Heath tells me they only stock parts for five years after production ends. Call Heath for more details if you're looking for parts.

I have about 200 copies left of the *Hot Water Handbook* (containing modifications for the Heath HW series of rigs). After they're gone, that's it! There'll be no more printed. If you want a copy, send $8.95 to me, Mike Bryce WB8VGE, at the above address.

Since we have covered both the HW-8 and the HW-9, pick up one at the hamfest. They're a lot of fun to fix and modify, and with the days growing shorter, tinkering is especially fun. 73

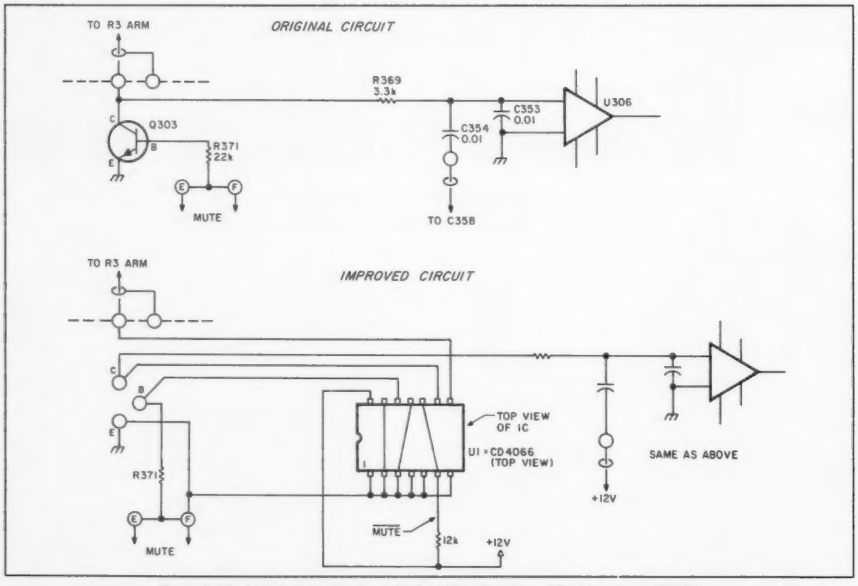

Figure 1. The key-thump suppressor for the HW-9. Courtesy of Paul Levesque KB1MJ.

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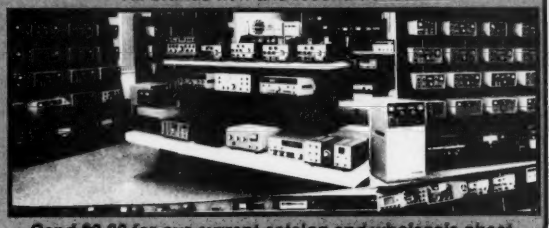

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CIRCLE 54 ON READER SERVICE CARD

the technology of the information age. Yet I feel I'm getting nowhere in helping this desperately needed growth. We're seeing a spurt now as a result of the no-code license, but I had to fight the ARRL for that damned thing for 30 years. Heck, we wouldn't have a Novice license now if it hadn't been for FCC Commissioner George Sterling W1AE jamming it down the ARRL throats.

Once you understand how our American system works, it's easy to make money. Pathetically easy. And, at the same time, you can do things which need to be done to improve the world. I've been working on improving amateur radio and, my ego says, having occasional successes. I'm working to improve the music, the publishing, and the educational businesses.

When you work smart you have time to play too, so it being apple season right now, I'm spending a couple hours a day canning my homemade applesauce...the best in the world. You know, I should plant a whole orchard of Golden Transparent apples and go into the business of making this applesauce. There's nothing like it at any price, and it lasts perfectly for years when you freeze it. If you stop by and say hello, I'll give you a taste and completely ruin your acceptance of canned applesauce for life. Hmmm, let's see...if each tree will make about 300 quarts every two years....

No, I've got to stop coming up with new business ideas. Did I tell you about my "Hurry Curry" business? Probably not, since someone would surely make zillions with it, and all I'd get would be a 1% chance at gratitude. That's a good one to save for my old age.

Tell you what: If you'd like to take off a few days and talk with me about building amateur radio, making money, and such trivia, you're invited to attend the 16th Annual Winter Ham Colloquium in Aspen, February 1–8. We'll ski during the day, HTs in hand, in order to clear our minds for the strenuous evening dinner conferences. Just be there and check in on the local repeater for conference details. Chuck KO1I will lead the expert skiers. I'll be in charge of the aged and infirm who have to stick to the intermediate slopes. Just one more year and I get to ski free!

Shooting The Messenger

Having had a note from a reader about his frustrations in trying to get Bell Helicopters to correct a fault in the wiring harness of a new helicopter, I was interested to find that he'd been laid off...and that the V-22 he warned them about crashed on its maiden flight.

In talking with amateurs in government, the military, large corporations and educational institutions, I've found many (most) of them frustrated by poor management and waste. Their frustration eats at them because they hate to see things going wrong, but feel helpless to do anything about it. They know what happens to whistle-blowers, and it isn't pretty.

QSL of the Month To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year Subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

One enormous source of bureaucratic waste, for instance, is the frantic spending of allocated funds at the fiscal year end. Bureaucracies work on the basis of ever-increasing funding. They know if they don't spend everything allocated, their funding will be cut the next year. The people working in these bureaucracies understand the system, but they also hate it. No one likes to see money wasted...not even public money. The punishment of whistle-blowers enforces a conspiracy of silence.

I'm sure there were many people who knew what was going on with the savings and loans...and many well aware of the BCCI scams. They also saw what happened to the few people who were foolish enough to try and wave the red flag. The lucky ones just got fired.

I suppose you haven't bothered to read P.J. O'Rourke's recent *Parliament of Whores*, so you don't know what a fake the federal budget is, and how Congress is a willing part of this whole scam. (You've also probably heard of Parkinson's Law, but have you ever read his 1957 book? Great stuff!).

P.J. tells us that the emperor has no clothes, that the whole mess is baloney. He makes a solid case. And from the endless horror stories I've heard from hams working in the government and the military, P.J. is not exaggerating. One of the things I recommended as a way to help balance the budget was to set up a federal whistle-blowers protection program...perhaps relocating them just as they do helpful criminals. After all, to bureaucrats, whistle-blowers *are* criminals.

If President Bush ever gets more interested in solving our national problems than in curing those of Cyprus, this might be a good starting point. I doubt there is a government agency other than the FCC that wouldn't be enormously improved by cutting its appropriation by 10% per year for the next ten years. That would cut them down to about 35% of what they get today, and it probably would all have to go to pay the generous government pensions. The drop in paperwork alone would allow millions of acres of Canadian forests to regrow.

And The Post Office

While we're cleaning up the mess in Washington, let's lean on congress to take away the monopoly from the post office. That'll put it out of its misery in short order. We might even start exchanging QSL cards again.

Private industry could do an infinitely better job at a fraction of the cost. Oldtimers can remember when we'd contact someone and automatically send them a QSL card. I'm old enough to remember the penny post card. Many of my old QSL cards have 3¢ stamps on them.

There used to be dozens of major QSL card printers. It was a nice business for a retired ham. All it took as a Kelsey press and a classified ad in a ham magazine. I've still got my old press out in the barn somewhere, complete with several large trays of type. Boy, that was fun!

Perhaps it's getting time to build fax modems into our transceivers so we can end contacts with faxed QSLs. We could fill in the "card" on our computers (any kind) with the call, report, and a short message. Anyone up to writing an article on the details? Yep, it'll be black and white for now, but color printers are getting cheaper, so we'll eventually be able to swap full color QSLs. That'll save us about 30¢ on local QSLs and much more on DX QSLs. I can see the day coming when we'll be able to work all continents in ten minutes and have the QSL cards in hand to prove it.

Yes, I hear you old grouches grumbling about the cheats. Look, fogies, we've always had cheats. So what? I've been issuing DX awards for over 35 years, so I've seen the lengths some hams will go to. Weird.

I'm already on record as favoring limiting DX credit just to contest weekends. Then we can ask the rarer DX ops to send in disks with their logs and let a computer sort it all out. We're not worried about the 200 easy countries, just the 200 hard ones. I predict that the ARRL will be set up to handle DXCC disk logs about 12 years after we lose our last DX band.

The Rescue

During the freshman year in many colleges, the fraternities invite you over to meet them...and to see if they want you as a pledge. This is called "rushing." I visited a bunch, looking for one where I might fit in. The Dekes had a well-earned reputation for being drunks. The Alphas were snobbish rich kids...even had their own bowling alley in their frat house. And so it went until I got rushed by Phi Ep. They seemed more my style, so I pledged.

The freshmen all lived in the freshmen dorms the first year. Then those who didn't make it into a fraternity moved to the upper-class dorms. The students separated into the Greeks and the Geeks.

My prospective fraternity brothers loved the hazing, making life miserable for us pledges. This consisted of making us uncomfortable psychologically and physically. For instance I was given about ten minutes to learn the Greek alphabet, interspersed with a good deal of "assume the position," which was followed by all the batting strength our best ball players could muster. I still know the Greek alphabet.

I suspect that if ham clubs would apply this system to new members to get

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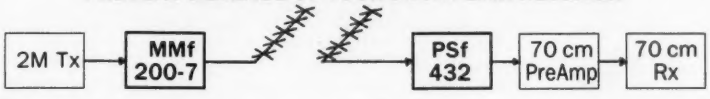

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CIRCLE 153 ON READER SERVICE CARD

them to learn the code we'd solve that problem.

One standard hazing routine was to take the pledges out and get them lost. So about one in the morning one cold snowy night four of us were blindfolded and driven for about a half hour and then two of us were dropped off on a back country road. The car drove off with the other two, leaving us in the snow, with no hint as to which way to walk. There wasn't even a glow in the sky to head for. Worse, there weren't even any other tire tracks in the snow to suggest that more cars might come along. We sighed and started walking.

About five minutes later we saw the lights of an approaching car! At this time of night they'd never stop, but as it zipped by we tried to flag it down. It skidded to a stop and a voice shouted back, "Hey Wayne, is that you?" It was Car-mine Mirenda W2MAM, from the next fraternity down the street from ours.

Carmine dumped out his two pledges and picked us up. It turned out that this was a popular pledge dumping spot. My fellow pledge and I earned an extra beating for getting back to the fraternity house before the brothers who had dumped us. No, we never explained how we did it, but we sure had the laugh on them. Our other two pledges dragged themselves in the next afternoon. If Carmine hadn't recognized me we'd have gotten back around the same time.

Though Phi Ep was in an old beat-up brownstone house in a crummy section of town, and it was about the only non-national fraternity, I didn't mind. I found I'd picked well when the next year we won the intrafraternity sports trophy, the intrafraternity scholarship trophy, and got our president elected the Grand Marshal of the school. We capped that by buying the ex-governor's mansion, moving to the most exclusive part of town, and becoming a Sigma Chi chapter.

I'm afraid my grades didn't help us with the scholarship trophy, and my bowling (195) as third man on the team wasn't a big boost toward the sports trophy, but my modulator powered one heck of a public address system, filling the campus with hi-fi sound and election propaganda.

It had been tough putting up antennas in the brownstone row of houses, but in the new house there was enough room for me to put up *two* 20 meter Twin-Three beams. I worked out like a bandit. I had both a 75m kilowatt (203Zs) and an all-band kilowatt (813s). I put out a humongous signal on all bands. Those homemade W8JK Twin-Three beams were killers.

Alas, Carmine, who weighed in at around 400 pounds, not surprisingly won the coveted Silent Key award while he was still quite young.

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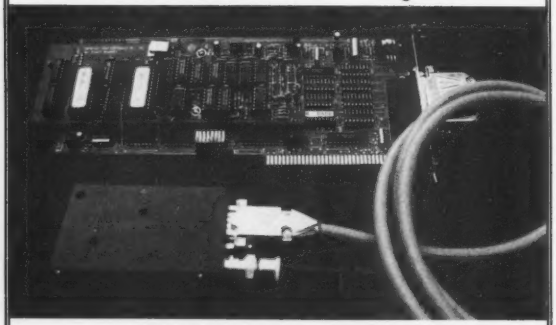

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CIRCLE 291 ON READER SERVICE CARD

Is No-Code Working?

Yep, so far. Looking at the new license figures from the FCC for the February–June period, I see that 1989 went up 2% over 1988, 1990 went up 9%, and 1991 is up 56%. That's a big jump. May was up over 100% from last year. Will it last? The mail I'm getting from clubs around the country is encouraging.

Clubs are reporting substantial increases in their licensing classes. Getting 'em to send me pictures to prove it, is harder than getting 'em to organize group subscriptions to the magazine. Despite almost every family in America having a camera, getting club pictures of ham classes has so far turned out to be a bust.

I'm getting two kinds of letters about no-code. One is from old-timers who are still convinced that no-coders will turn our bands into CB-like messes. The other letters are from readers who have been in contact with these new licensees and are impressed by what good operators they are.

I'm also getting stacks of letters from no-coders thanking me for helping make their license possible. And every one of them has mentioned that now they're working on the code so they can get their Novice and get on 10m...and then their General. The letters from the old-timers who are still living in their dream (nightmare) world and who have made no effort to check what's actually happening are in wonderful contrast to the others.

I'm hearing from more and more clubs with license classes filling up. Who knows, this enthusiasm may not be a temporary blip. But we still have a long way to go before we're anywhere near the growth we had from 1946–1964, before the ARRL's "Incentive Licensing" debacle killed the American radio industry.

Now we have an answer for the kids who argue that the code is a useless relic of the past. No problem; get your ticket and join the fun on 2m and up. It gives us a little easier "sell" to youngsters who turn up on CB and find it frustrating.

Has your club appointed some hunters to prowl 11m, looking for new meat? CB is prime hunting ground for potential hams, but you have to catch 'em quick, before they get fed up and quit.

One more thing. Let's not inculcate these newcomers to 2m with the really rotten things some old-timers have almost developed into an art form. Like not answering when a newcomer calls in on the repeater.

Let's see, where was I the other day? Oh yes, New York. I was way up high in the Empire Hotel by Lincoln Center and was able to kerchunk a dozen repeaters. I gave my call and asked if anyone was listening. I got answers on two repeaters. Two! One was in New Jersey. And no, no one was avoiding me. I don't think anyone ever gets my call right the first time...and few hams recognize it even when they do finally get it. Maybe 10% put W2NSD and WG together.

Look here, this is a hobby with all of us fraternity brothers, so let's be friendly, helpful and make hamming fun. I really hate it when I need to get word through that I'm going to be late to meet a friend for dinner, only to get refused by hams and have to ask CBers to get help...which they cheerfully do. I'll bet I won't get turned down by a no-coder...unless some bozo gets to 'em first and louses up their head.

New National Park Proposed

The inside word is that the League directors are considering submitting a proposal to the FCC which would set aside the upper half of the 75m phone band as an Old Hams' Home...a retirement community made up of retired hams who are too unskilled, too lazy, or too poor to spend what's left of their unproductive lives playing golf.

Theirs is a force which some directors feel should be harnessed. There's even been talk of establishing special teaching channels along the edge of the Old Hams' Home where they would be able to instruct ham newcomers on proper language...with guest lecturers imported from 14,313.

Baxter K1MAN may be asked to prepare tapes for 24-hour-a-day broadcasting on a reserved channel, with endless readings from the current issues of *QST*...including all the ads. Baxter's great experience in non-stop broadcasting on the ham bands makes him eminently qualified for this service.

I understand that Dick Bash may be available to teach youngsters how to pass the 20 wpm code test without any knowledge of Morse whatever. And a special channel is proposed for making deals with VECs for mail-order exams so all certifiable Old Hams can get their Extra Class tickets without being overcharged.

The unfortunate FCC clampdown on the KP4 license mill has forced ticket prices beyond the reach of many old-timers. Extra Class, which used to go for only $100 is now more like $500, which is still a bargain for the top-of-the-line license...hassle-free. Advanced seem to be going for around $250. And no, don't bother writing me to find out where to buy your license.

Special net channels and times will be established and enforced for the discussion of no-code, CBers, space cadets, lids, K1MAN, KV4FZ, AM, women, homosexuals, blacks, atheists, Japs, A-rabs, DX lists, contests, net jamming, etc.

Facing reality, the directors are said to be favoring a 10 kW power limit for this National Park Band. Since some of them already qualify to operate in the band, perhaps they don't want to have to operate just with their exciters to be legal. Seems reasonable to me.

Please send your comments to K1ZZ, ARRL, Newington CT 06111...with a copy to me. 73

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The Tech Answer Man

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More Parts

Last month, we were discussing parts and how to manage them. Let's finish it up:

Keep Chippin' Away

Along with digital chips, analog or "linear" ICs also abound. For instance, most walkies today make use of the LM386 chip for their audio output sections. In some, a "real" LM386 is used, while in others, smaller versions and surface-mount chips with the same internal construction are employed. As with the digital chips, the ammended part numbers may obscure the generic type. For instance, the Kenwood TH-77A dual-band walkie uses the NJM386BM, while the Yaesu FT-411 has the NJM386D. The Kenwood also uses a couple of TC4066BF chips, which are just common 4066B analog switches, although they may be surface-mount mini chips (I haven't opened the rig to find out).

Also found are plenty of op amps. These, too, often have common numbers embedded in their designators. In any case, *any* time you want to replace a chip with one you think is essentially the same, be sure to compare the schematics for the pinouts first. Even if the chips do turn out to be functionally identical, there can be different pinouts, particularly when package types are different.

What Has Three Legs and Amplifies?

While there are lots of chips in our gear, many other semiconductors are used as well. Obviously, one of the most important is the transistor. Perhaps no other category of part has as many types as does the three-legged beast. I can't begin to cover them all here, but I'll try to touch on the major kinds.

Bipolar, or "common," NPN and PNP transistors are still the most often used. They can be found in just about any part of a radio's circuitry, from the front end to the audio amp. Nearly all voltage regulators, RF output stages and discrete audio output amps are made from bipolar transistors. The standard three-legged diagram with the diagonal leads and the arrow is the giveaway. If the arrow points out, the part is NPN; if it points in, it is PNP. What does this mean? It refers to the polarity properties of the internal semiconducting layers, and the shorthand gives you a clue as to which polarities must be applied to make the device turn on. To make an NPN transistor turn on, the base (which is the "P" in NPN) must be positive with respect to the emitter. To turn on a PNP, the base must be negative with respect to the emitter. Note that it doesn't matter what the "actual" polarity (with respect to circuit ground) is; only the emitter is used as a reference. Thus, a PNP transistor can be used in a positive-voltage circuit, with its base being pulled lower (less positive) than its emitter; that's the same thing as negative, as far as the transistor is concerned, and it will turn on.

Oops, I digressed a bit there, but for a reason. If you want to replace a bipolar transistor with one with a different part number (which is very often the case because there are so many kinds, and you can't get many of them), you must first narrow your choice to a part with the same polarity. You just can't replace an NPN with a PNP. By the way, the vast majority of transistors used today are NPN. PNPs, which are harder to make, are used only when really necessary, such as in push-pull (complementary) amplifiers and low-loss voltage regulators.

Besides polarity, the most important specs for bipolar transistors are cutoff frequency, gain, power dissipation and voltage breakdown rating. Whew, that's a lot! This would seem to suggest that it would be impossible to cross a transistor to another part but, in practice, it's done all the time. First, decide what the transistor is doing. If it's in an audio amp and is not part of a complementary pair (in other words, it doesn't have an opposite-polarity transistor connected on top of or below it), chances are that any similar part of similar power-handling characteristics will do the job. If it is part of a pair, you can still replace it with another kind of part as long as you replace its mate with the new part's mate. If you don't, you are likely to wind up with mismatched parts, which will cause signal distortion, uneven current distribution, overheating and premature part failure of either your new part or the old mate.

By the Numbers

A few words about Japanese transistor part numbers: most parts start with either 2N, 2SA, 2SB, 2SC or 2SD. 2SAs and 2SBs are PNP, while 2SCs and 2SDs are NPN. Many techs have been mystified by parts with numbers like "C945." It pays to know that the manufacturers often leave the 2S designator off the part to save space. So, a C945 is actually a 2SC945, which is a very common part. A number which starts with a "3" signifies an FET.

FETs

The FET (Field Effect Transistor) is an entirely different kind of transistor. It uses the "field effect" to regulate electron flow through an internal channel. Its leads have different names: Gate, Source and Drain (instead of Base, Emitter, and Collector).

The gate is analogous to a bipolar part's base, while the drain is like the collector, and the source is like the emitter. In some FETs, the drain and source may be interchanged while, in others, that is not possible. The diagrams look different, too.

In JFETs (junction FETs), the leads all exit straight, not diagonally, and the arrow is in the gate lead in the middle. The arrow points the "other way," too. P-channel FETs have outward-pointing arrows, while N-channel parts have them pointing inward.

In MOSFETs (which have no actual junction between the gate and other leads), the gate is shown as a line separate from and parallel to the one which joins the other leads. No matter what kind of FET you are working with, the important thing to remember is that, as with bipolar parts, you cannot replace a P type with an N type or vice versa. Also, you can't substitute JFETs and MOSFETs for each other.

Power FETs are similar to normal MOSFETs, only they are bigger and can handle much larger amounts of power, just like bipolar power transistors. They have the same basic characteristics as the smaller MOSFETs. They are just starting to find their way into our gear, but they are great parts and seldom fail unless badly overstressed. Their part numbers are very different, and may be something like "IRF511." If in doubt, look at the diagram. Needless to say, you can't replace an FET with a bipolar, or a bipolar with an FET. Their characteristics are just too different.

There are some other, obscure kinds of transistors. One that comes to mind is the unijunction transistor. This thing has a diagram that looks like a bipolar part, except that the base comes in at an angle. Unijunctions are used primarily as pulse generators and oscillators, but they are rare. I haven't seen one for a long time.

Look it Up

A great way to find a transistor substitute that will work is to get a transistor substitution book which lists the "generic" American parts, such as those by GE or RCA. Then, look up the part you want to replace and see what the generic replacement is. Now, look up the part you have available. If it is replaced by the same generic, it will probably work. Even if it isn't, you can look at the specs on the generics and see if they are similar. Beware, though: I have found errors in these books. In a few cases, a large heat-sinked power transistor was crossed to a tiny, milliwatt-level part. In such a case, common sense must prevail; don't try the replacement if you don't like smoke!

Walking on Two Legs

Two-legged semiconductors are usually much easier to substitute. Nearly all the two-legged beasts you will encounter are rectifying diodes. The ones that go bad are usually found in power supplies. In a normal, linear-regulated AC power supply, just about any diode of high enough voltage and current capacity will work fine. A common number would be 1N4002. By the way, those four-legged bridge diodes can be replaced with standard diodes wired to emulate them, again as long as the voltage and current ratings are adequate.

In switching supplies and regulators, high-speed diodes are used and the regular types just won't work. Your substitution book should cover most of these things.

Zener diodes are used as voltage regulating elements. Their diagram looks like that of a diode, except that there are slanted lines exiting from the central one. Zeners operate by breaking down in the reverse direction at a preset voltage. Their essential characteristics are the breakdown or "zener" voltage and the power dissipation capabilities. Nearly all the voltages can be had in generic parts, so it is usually not too hard to substitute zeners.

Small-signal switching diodes typically are of the 1N914 or 1N4148 variety. They are pretty much all interchangeable. Some low-noise switching diodes are used in transceivers, though. If you replace one with a standard diode, it probably will still work, but the circuit's performance may be degraded due to noise generated in the cheaper part. Manufacturers only spend extra for the low-noise diodes when they have to, so it pays to replace such a part with another low-noise one.

Varactor diodes are not really diodes in the rectifying sense, but they have two leads, hence the name. They are really voltage-variable capacitors and should be replaced with exact part numbers or parts with the same capacitance and sensitivity characteristics.

"Hot carrier" and other exotic diodes are sometimes used in mixers and the front ends of receivers, especially in the VHF-and-up range. For correct circuit performance, it is important to replace them with the same types.

Home-brewing

If you're building something from scratch, you may have great leeway in selecting which parts you'll use. In fact, if you have a well-stocked "junk box," you may find yourself designing your circuit to use what you have! This technique can save lots of time and money, but your gadget may not be easily reproducible by others, because those special parts you've been squirreling away since 1957 may have gone out of style. Especially if you want your device published, it pays to use as many standard parts as possible, and to avoid unavailable ones like the plague.

Playing the Standards

So just what constitutes "standard" parts? Well, 2N3904 and 2N3906 transistors are about the most common kind available in the USA. Ditto for 1N914 and 1N4148 switching diodes and 1N4000-series power rectifiers.

If you're designing a digital circuit that doesn't have to operate faster than a few megahertz, consider using 4000-series CMOS parts. They use very little power, do not require regulated power supplies, and are very available. All in all, they are much easier to work with than are TTL and LSTTL chips.

In op amps, the TL-072 and TL-074 are common, as are the 1458 and similar numbers. In voltage regulators, the three-terminal National parts, such as the LM317 and the LM340, are virtual standards.

Well, I promised the addresses of various parts sources but, alas, I'm out of space again. I'll have them all for you next month. See you then. 73

Number 24 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

Freedom

By the time you read this, things will hopefully have calmed in the Soviet Union. As I write this, the right wing coup is less than 24 hours old. Gorbachev is under house arrest and has yet to surface. Yeltsin is defying the order to vacate his offices, has called for a general strike, and a warrant has been issued for his arrest. Tanks surround the Kremlin, and the world is waiting to see the response from the several republics that have recently tried to declare their independence from the Soviet Union.

As I watch the events in the Soviet Union unfold before me on my television, one word keeps coming to mind: Freedom.

The people of the Soviet Union have, for the first time in their long and tragic history, been served up a small taste from the plate of freedom. Will they be happy with the memory of this brief period of openness, or will they stand up en masse and declare to the power brokers of their society that they refuse to go back to the old ways of repression, fear and dictatorship?

By the time you read this the events will probably have run their course and the outcome will be apparent. For now, watching this giant nation struggle with itself from the comfort of my living room, all I can think of is that one word: Freedom.

Depending on how much of it you have, freedom means different things to different people. It can mean the freedom to speak your mind and criticize the government, without the risk of being thrown in prison. It can mean the right to publish or purchase a copy of Penthouse—or a copy of the Bible (in the U.S., the same article of the constitution covers both). It can mean the right to worship God in your own way, whatever your concept of God happens to be. It can mean the right to work for a fair wage, and that you will not be judged by the color of your skin, the religion you subscribe to, or your gender.

Freedom to a struggling farmer in a third world country may consist solely of being able to provide food and shelter for his family.

Here in the United States, we enjoy an abundant supply of freedom. Our laws of free speech and expression go so far as to allow us to take the symbol of our freedom, the flag, and publicly destroy it in protest. We can stand in front of the residence of our president and shout at him all day long. We can assemble by the hundreds of thousands in front of the Capitol building and express our outrage. Every few years, we have a quiet revolution—it's called election day. Whether it's a senatorial, congressional or presidential election, our system has been set up so that no person can remain in power without the consent of those who bestow that power—the people.

What has all this got to do with amateur radio? Plenty! What do you think it is that gives you the right to tune up on 40 meters and call CQ? What gives you the right to comment on a proposed rule change by the FCC? What gives you the right to tell your congressman that unless he supports a certain bill, he'll be looking for a new job after the next election?

The freedom we exercise every time we fire up the ol' rig is the same freedom that allows some to hang out on 75 meters every night and tell dirty jokes with their friends. The freedom that allows me to trade a recipe for alfredo sauce over packet is the same freedom that allows those screwballs on 14.313 to tie up that end of the 20 meter band with their endless banality, bigotry and bull. Every time we hit that push-to-talk switch, we are taking advantage of freedom.

As we all learned in high school social studies class, freedom carries with it responsibility. Have you ever really pondered what that means to us as amateur radio operators? Every time we transmit, we are giving evidence to how well we are handling the responsibility of some very powerful freedom. Are we exercising that freedom responsibly, thereby guaranteeing it for the next generation, or are we taking advantage of that freedom to serve our own ego?

I'm not advocating that all communication on the amateur bands needs to be dull. I love to get into intelligent discussions of politics and religion, as long as they don't decay into name calling and hurt feelings. I've listened in on—and participated in—some pretty lively QSOs about such topics as the Gulf War, no-code, President Bush's domestic policies (or lack thereof), the recession, the homeless, Islamic fundamentalism . . . the list is endless. Each of these conversations was a heated debate, conducted by people with strongly held ideas and opinions, yet they all respected the responsibility that the freedom of speech demands. They had respect for the fact that they were choosing to exercise their freedom in a public place.

Whenever you transmit on an HF band, there is the likely possibility that you are being monitored by people in several countries. Each of these countries is different, with a different concept of freedom, yet most of these countries have a say in whether or not you and I, as radio amateurs, will be allowed to continue to exercise this freedom via radio waves. Are we showing, by our actions, that the free exchange of ideas, educational opportunities, and international goodwill offered by amateur radio is worth more to a developing nation than a shortwave broadcast allocation?

We do not have a right to the frequencies we occupy. Amateur radio is a privilege, not a right. It is a privilege that we, as a nation, have bestowed upon ourselves. A nation of 250 million has decided to let a group of less than 500,000 occupy some very valuable frequency spectrum. If the nation ever decides that our frequencies could be better utilized by some other service, we will lose those frequencies faster than you can say "majority rules."

Right now, radio amateurs have an enormous amount of freedom. Whether or not we can maintain it is totally up to us and how we exercise that freedom. What's going on in the Soviet Union this hot August night serves to remind us just how fragile that freedom is. 73

Number 25 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

October is expected to be a very good month for propagation on short-path, long-path, and intermediate-path distances to DX locations. Although the solar flux continues to slowly decline, with occasional spurts to higher levels, the inexorable reduction in sunspots is going to take its toll.

Early darkness will tend to cause the bands higher than 14 MHz to close shortly before or after dark, while the bands below 14 MHz will begin to come alive for DX. Because of good opportunities for grayline DX (along the path of darkness), you can often make some excellent DX cntacts shortly before or after dark and dawn, local time. Morning and afternoon DX will be great, however, from 14–30 MHz.

The best days for propagation will be more numerous than usual, with the really poor days concentrated around the 17th through the 22nd of the month. The appended chart will show you Good (G), Fair (F), and Poor (P) days, and those marked with two letters showing trends toward better or poorer conditions.

Those of you who enjoy DX on top band (160 meters), 80–75 meters, and 40–30 meters, will really enjoy October. During that season, the QRN levels decrease in the Northern Hemispehre due to fewer storms. There are fewer storms because of lower sun angles and less atmospheric heating and vertical mixing. Storm fronts may tend to be slower moving, but the tendency for prolonged high pressure areas to remain over large segments of the U.S. will prevail. VHF/UHFers should be sure to look for tropospheric ducting along weather fronts.

Keep a sharp lookout for some pretty harsh geophysical effects on the days indicated as poor. My guess is that the 18th, 19th, and 20th will be most critical this month. Batten down the hatches on those days, and look for us again in November. See you then. de W1XU 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	—	—	20	20	—	—	—	—	15,17
ARGENTINA	15,17	15,17	20	20	—	--	—	—	—	15,17	15,17	15,17
AUSTRALIA	15,17	15,17	—	20	20	—	20,40	20	—	—	—	—
CANAL ZONE	20	20	20	20	20	20	20	20	15,17	15,17	15,17	15,17
ENGLAND	20	20	20,40	—	—	—	—	15,17	15,17	—	15,17	20
HAWAII	15,17	15,17	20	20	20	20	20	—	—	—	15,17	15,17
INDIA	20"	20"	—	20"	20"	—	—	—	—	—	—	15,17
JAPAN	—	—	—	—	—	20	20	—	—	—	—	15,17
MEXICO	20	20	20	20	20	20	20	15,17	15,17	15,17	15,17	15,17
PHILIPPINES	—	—	20	—	—	20"	20"	15,17	15,17	—	—	—
PUERTO RICO	20	20	20	20	20	20	20	15,17	15,17	15,17	15,17	15,17
SOUTH AFRICA	—	40"	20	20	20	—	—	15,17	15,17	20	—	—
U.S.S.R.	20	20,40	20,40	—	—	—	—	—	—	15,17	15,17	20
WEST COAST	15,17	15,17	40,80	80,160	40	40	40	—	20	15,17	15,17	15,17

CENTRAL UNITED STATES TO:

ALASKA	15,17	—	—	—	—	20	20	20	—	—	—	15,17
ARGENTINA	15,17	15,17	20	—	—	20"	—	—	—	—	15,17	15,17
AUSTRALIA	15,17	15,17	—	20	20	—	20	—	—	—	15,17	15,17
CANAL ZONE	15,17	20	20	20	—	20	20	15,17	15,17	15,17	15,17	15,17
ENGLAND	20	20	—	—	—	20"	—	—	—	—	15,17	15,17
HAWAII	—	—	20	20	20,40	—	20	—	15,17	15,17	15,17	15,17
INDIA	15,17	20"	—	—	—	20"	20"	—	—	—	—	15,17
JAPAN	15,17	—	—	—	—	20	20	20	—	—	—	15,17
MEXICO	15,17	20	20	20	—	20	20	15,17	15,17	15,17	15,17	15,17
PHILIPPINES	15,17	—	20"	—	—	—	20"	20"	—	—	—	—
PUERTO RICO	15,17	20	20	20	—	20	20	20	15,17	15,17	15,17	15,17
SOUTH AFRICA	—	—	20,40	20"	—	—	—	15,17	15,17	20"	—	—
U.S.S.R.	20	20	20	20	—	20"	—	—	15,17	15,17	15,17	20

WESTERN UNITED STATES TO:

ALASKA	15,17	20	20	20	20	20	—	20	15,17	15,17	15,17	15,17
ARGENTINA	15,17	15,17	15,17	20	20	—	—	—	—	—	15,17	15,17
AUSTRALIA	15,17	15,17	15,17	20	20	20,40	20,40	20	—	—	—	15,17
CANAL ZONE	15,17	15,17	20	20	20	—	—	—	—	15,17	15,17	15,17
ENGLAND	20	20	20	20	—	20"	—	15,17	15,17	—	—	20
HAWAII	15,17	15,17	20	20	40	40	20	20	—	15,17	15,17	15,17
INDIA	—	15,17	15,17	—	—	—	20"	20"	15,17	15,17	—	—
JAPAN	15,17	20	20	20	20	20	—	20	15,17	15,17	15,17	15,17
MEXICO	15,17	15,17	20	20	20	—	—	—	—	15,17	15,17	15,17
PHILIPPINES	—	15,17	15,17	—	—	20	20	20	15,17	—	—	—
PUERTO RICO	15,17	15,17	20	20	20	—	—	—	—	15,17	15,17	15,17
SOUTH AFRICA	—	—	—	20"	—	—	—	20"	15,17	15,17	—	—
U.S.S.R.	20	20"	20"	20"	—	—	—	—	—	—	—	20
EAST COAST	15,17	15,17	40,80	80,160	40	40	40	—	20	15,17	15,17	15,17

Notes: (1) Possible but rare dual bands (10 or 12, 15 or 17, 20 or 40). Try where shown. The highest possible bands shown. Also try next lower band at times shown.

OCTOBER 1991

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G	2 G	3 G–F	4 F	5 F–G
6 F–G	7 F–G	8 F	9 F–G	10 G	11 G–F	12 G–F
13 G–F	14 G	15 G	16 G–F	17 F–P	18 P	19 P
20 P	21 P	22 P	23 P–F	24 F–G	25 G	26 G
27 G	28 G	29 G	30 G	31 G		

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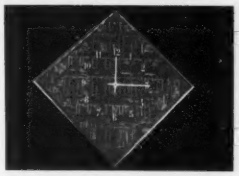

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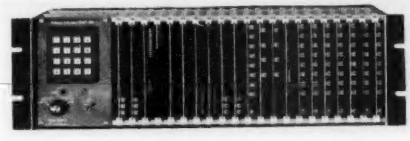

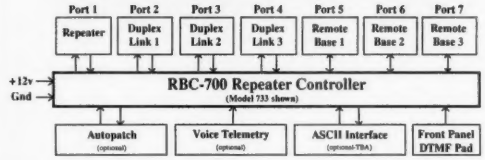

The RBC-700 Repeater Controller is designed to support Repeater systems that require multiple radios connected together at a site. The RBC-700 utilizes a true 7 x 7 audio matrix switch which allows several conversations between ports at the same time. In the illustration above the 733 model is supporting a Repeater, 3 Duplexed Links to different sites, and 3 Remote Bases. Using simple commands, a user could tie the Repeater and a Remote Base to one Link, while the other Links are communicating through your site, holding separate conversations. Or, connect all of the ports together - like a big party line !!

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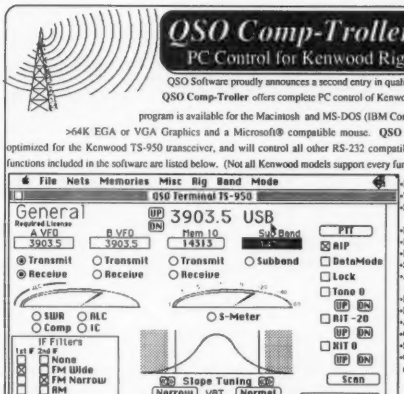

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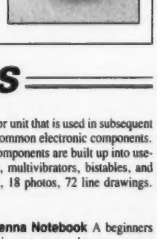

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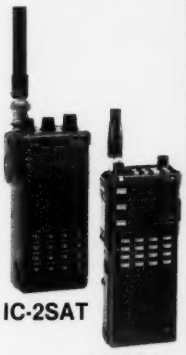

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